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THE
GEOGRAPHICAL REVIEW

VOL. V JUNE, 1918 NO. 6

THE BELCHER ISLANDS OF HUDSON BAY: THEIR DISCOVERY AND EXPLORATION

By ROBERT J. FLAHERTY

[With separate map, Pl. IV, facing p. 440.]

In August, 1910, Sir William Mackenzie, president of the Canadian Northern Railway, engaged the writer to undertake a journey to the Nastapoka Islands, outliers of the east coast of Hudson Bay in 56° 5′–57° 50′ N., for the purpose of examining and reporting upon the commercial value of the iron-ore deposits found upon certain members of the group. Sir William's interest in these deposits was connected with his interest in the new Hudson Bay route for the shipment of grain from the Manitoba grain fields to the European market and the opening of the bay to commerce by rail with Lower Canada and by ship through Hudson Strait with England. The route[1] projected is from Le Pas, a branch line terminal of Sir William's transcontinental railway, to Port Nelson on the west-central coast of Hudson Bay, thence by ship through Hudson Strait and across the North Atlantic to Liverpool. This is a project which, if practicable—a matter still in question—is interesting not only because it would provide a wheat route shorter by a thousand miles than those now in use, but because it would also make immediately available such resources of the vast seaboard of Hudson Bay as might be found to be of commercial extent and of advantageous situation on or near tide water.

This seaboard bounds an area 1,200 miles long by 600 miles wide, 350,000 square miles of inland sea, and embraces the semi-arable hinterland of northern Ontario and northwestern Quebec, the semi-barrens of the Indians, the barrens of the Eskimos, and an arctic area of perpetual ice-bound sea. Nearly two-thirds of this region, indeed, lies within the subarctic and arctic zones of climate.

[1] For a full account see J. A. Cormie: The Hudson Bay Route, *Geogr. Rev.*, Vol. 4, 1917, pp. 26-40.

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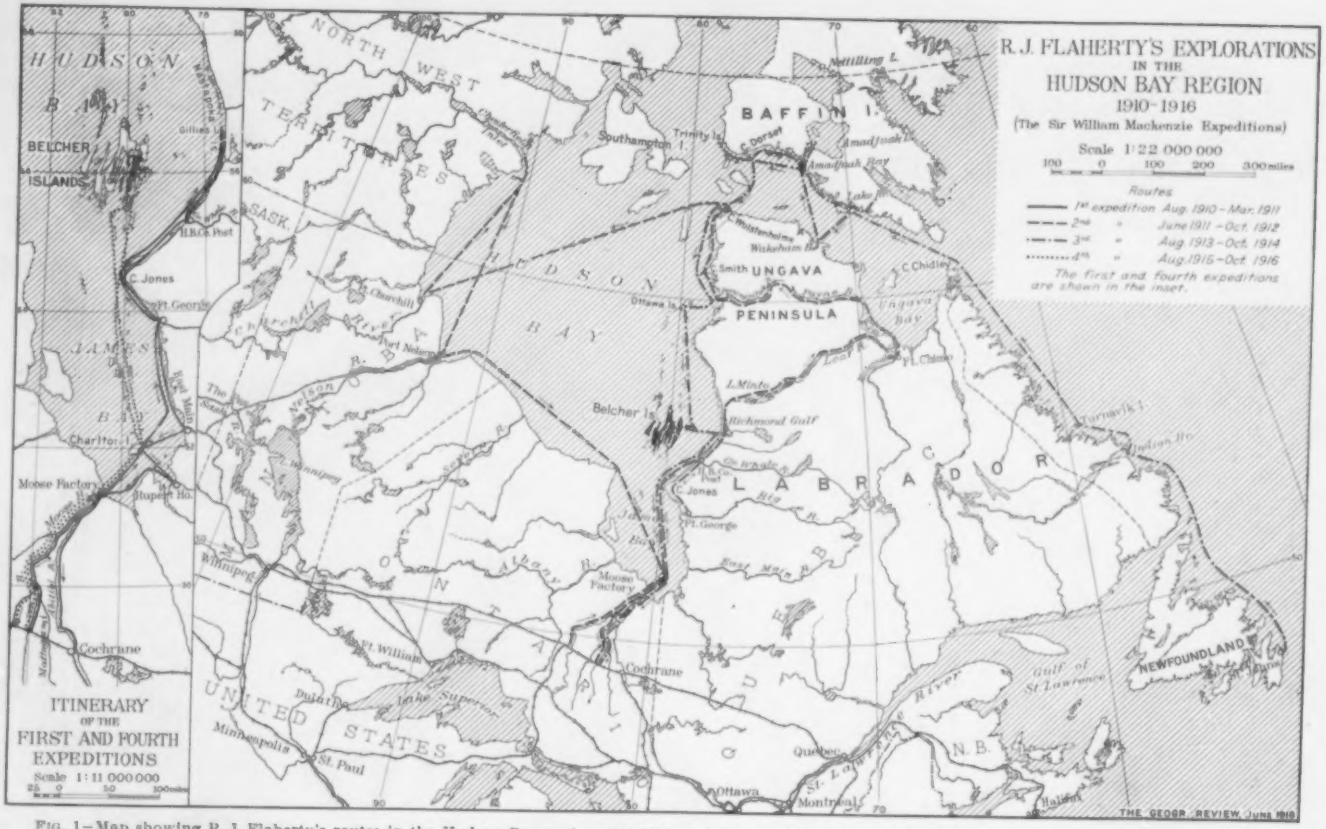

FIG. 1—Map showing R. J. Flaherty's routes in the Hudson Bay region, 1910-1916, and the location of the Belcher Islands in their actual extent as determined on these expeditions. Scale, 1:22,000,000. The inset, 1:11,000,000, shows the routes of the first and fourth expeditions.

Previous Explorations of the Hudson Bay Region

The white population of the region numbers some hundred and fifty "fur men," factors of the Hudson's Bay Company and their apprentices. From their posts, six along the east coast and six along the west, two hundred miles apart on an average, they control the trade of the country's native inhabitants, who themselves number less than three thousand all told. Exploration of the "East Main," as the east coast is locally termed, on the part of the Hudson's Bay Company has, despite their two and a half centuries of occupation, been negligible. Under their trading system the native brings his furs to their posts along the seaboard and thus renders unnecessary any expeditions on their part for trade extension—expeditions which would, if made, inevitably involve a certain amount of geographical exploration. Of the score or more of rivers that flow into James Bay and Hudson Bay along the east coast only two have been explored to their sources. The largest river entering James Bay, the Big River, is not only unexplored to its source but is unknown beyond sixty miles from its mouth. The country's vacant spaces therefore can be imagined.[2]

For such information as we have of the coast and its interior we are indebted largely to the remarkable explorations of the late A. P. Low, of the Canadian Geological Survey, whose work, covering a period of more than twenty years, has given us the most detailed and reliable maps and descriptions of the region available.[3] It was Low's detailed reports of the Nastapoka Island discoveries made in 1877 by Dr. Bell, also of the Canadian Geological Survey, that formed the basis of the investigations which I had been commissioned to make.

How this undertaking, involving three further expeditions extending over a period of six successive years, eventually led to the rediscovery, if such it may be called, of an island land mass more than 5,000 square miles in size, lying along the East Main almost within sight of sailing routes of the Hudson's Bay Company to the westward and within a hundred miles of the company's centuries-old post at Great Whale River to the eastward, is a matter of such interest that I give the incidents here just as they happened.

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[2] See the note on "The Unexplored Areas of Continental Canada," with maps, in the March *Review* (Vol. 5, 1918, pp. 233-237).—Edit. Note.

[3] A. P. Low: Report on Explorations in James' Bay and Country East of Hudson Bay, Drained by the Big, Great Whale and Clearwater Rivers, Report J of *Annual Rept. Geol. Survey of Canada*, Vol. 3 for 1888, Montreal, 1888.

Id.: Report on Explorations in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicuagan and Portions of Other Rivers in 1892-93-94-95, Report L of *Annual Rept. Geol. Survey of Canada*, Vol. 8 for 1895, Ottawa, 1896.

Id.: Report on a Traverse of the Northern Part of the Labrador Peninsula from Richmond Gulf to Ungava Bay, Report L of *Annual Rept. Geol. Survey of Canada*, Vol. 9 for 1896, Ottawa, 1898.

Id.: Report on an Exploration of the East Coast of Hudson Bay from Cape Wolstenholme to the South End of James Bay, Report D of *Annual Rept. Geol. Survey of Canada*, Vol. 13 for 1900, Ottawa, 1902.

Id.: Report on the Geology and Physical Character of the Nastapoka Islands, Hudson Bay, Report DD of *Annual Rept. Geol. Survey of Canada*, Vol. 13 for 1900, Ottawa, 1903.

Initial Journey to the Nastapokas

From the railway frontier of northern Ontario, in late August, 1910, I journeyed by canoe down the Mattagami and Moose Rivers to Moose Factory on James Bay, thence in a small Hudson Bay sailing craft across James Bay to Fort George on the east coast, where, weatherbound, I remained until the formation of the sea ice in December (see map, Fig. 1). The journey up the coast was then undertaken with relays of sledges with dog teams and native drivers; the first relay at Cape Jones, the northeastern extremity of James Bay, which marks the southern boundary of the subarctic habitat of the Eskimos; the second at Great Whale River, the most northerly post of the Hudson's Bay Company on the East Main, from which point a final 150 miles brought me to the Nastapokas—a distance all told from the railway frontier of 800 miles.

The Nastapoka Islands, ranging in size from a sea-swept reef to an island thirteen miles in length, are grouped in a chain for a distance of 120 miles at an average of four miles from the mainland, forming the spacious Nastapoka Sound. Save the southernmost they lie beyond the limit of trees; such vegetation as they contain—mosses, lichens, and creeping willows—is typically subarctic. The largest of the ore deposits are located on the two central islands of the group, Gillies and Clarke, which are 12 and 3½ miles in length respectively. Their eastern shore line is broken into a series of cliffs, rising, according to Low, to a maximum elevation of 350 feet, where the various rock members are everywhere graphically exposed. These rocks have been identified by Dr. C. K. Leith, of the University of Wisconsin, as of Animikean age. His identification he bases on a correlation with the Animikean rocks of the Lake Superior region, and its interest, economically considered, lies in the fact that it is to these Animikies and the enormous mineral deposits characteristically associated with them that the Lake Superior region in great measure owes its commercial importance.[4]

Reports about the Belcher Islands

The examination of Taylor and Gillies Islands completed (the ore deposits were found to be of no present economic interest), I prepared to return to the railway frontier. It was at this juncture that Nero, my

[4] Dr. Leith, who is a well-known authority on the geology of northern Minnesota and Michigan, made his examination of the Nastapokas during the summer preceding my own journey. His paper gives an excellent description of the island formations; his conclusions, offered tentatively owing to the limited time he had for investigation, he summarizes as follows:

"From an economic standpoint the repetition of essentially Lake Superior conditions in the Hudson Bay country cannot but be of interest, ... when it is remembered that the enormous deposits of iron, copper, nickel, and cobalt on the south side of the Archean protaxis are, with very few exceptions, associated with Algonkian rocks, and late Algonkian at that, rather than with Archean rocks. There are yet no discoveries to warrant close commercial comparison of the two regions." (C. K. Leith: An Algonkian Basin in Hudson Bay—A Comparison with the Lake Superior Basin, *Econ. Geology*, Vol. 5, 1910, pp. 227-246; reference on p. 246.)

For the narrative of the journey, which gives a good insight into the human geography of the region, see C. K. Leith and A. T. Leith: A Summer and Winter on Hudson Bay, 208 pp., Madison, Wis., 1912 (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, p. 770).

driver, one of the only two Eskimos of the seaboard who could speak English, mentioned large islands to seaward of the Nastapokas, where lived a tribe of Eskimos whose hunting ground contained great walrus herds, thousands of geese in spring, salmon, seal, bear, etc.—game supply being to a native the only characteristic of a strange land worth consideration. I remembered then, for the first time since leaving Charlton Island *en route* northward in the preceding fall, a map and interesting information I had received there concerning these same islands from a servant of the Hudson's Bay Company, an Eskimo, Wetalltok by name, head man of the encampment, whom the company had imported from the Great Whale seaboard some fifteen years previously. The map (Fig. 4), drawn on the reverse side of an old missionary lithograph, represented Wetalltok's hunting grounds previous to his migration—islands which on the admiralty charts (Fig. 2) are known as the North and South Belchers, shown there in dotted outline, the largest of them not more than six miles long.

The data for this rendering of the East Main islands on the admiralty charts[5] are taken from the maps and descriptions of Captain Coats, a noted shipmaster in the employ of the Hudson's Bay Company from 1727 to 1751. That Coats relied largely on Eskimo accounts for his notes is apparent from the following statement of his:[6]

> Belchers Islands, four in number, lyes forty-five leagues to westward of Litle Whale River; by another account, only twenty-nine leagues in latitude 56° 06′, where I was entangled three days in ice. I found a flood and ebb setting due east and west; but we drove to eastward most. I have made a computation of about four and a half miles a day. This increment to eastward, which is owing to those vast quantities of snow, which disolves and drains down our rivers from the western shore, amongst whom is good anchor ground.
>
> About seven leagues north from those is a range of islands twenty leagues in length, fourteen larger, and many smaller; the midle, in 58° 00′ N. latitude, at a distance of seventeen leagues from the east main, amongst which the Usquemows swarms all the summer months to catch fish and moulted fowl, in great abundance, uppon all these, Belchers and Sleeper islands. In latitude 59° 05′, we told fourteen islands in sight; and, by my account, the westermost is uppon the same meridian of the North Bear; and the North is 2° 50′ west longitude from Cape Diggs; and Gulph Hazard lyes 2° 05′ east longitude from Cape Diggs in 56° 22′ north latitude.

Wetalltok's map, on the other hand, showed a land mass of surprising extent. Calculating distances from point to point by Wetalltok's reckoning, i. e. travel time for kayak and dog team, we judged that the main island could hardly be less than 100 miles in length. That a land mass of such extent, however, could exist not a hundred miles to seaward of the centuries-old post at Great Whale River and remain unknown to the Hudson's Bay Company seemed to me altogether improbable, as it did also to the company's men to whom I mentioned the affair at the time—particularly

[5] Cf. Hudson Bay and Strait, British Admiralty Chart No. 863, mean scale 1:2,100,000, published 1884; 5th edition, 1910.

[6] John Barrow, edit.: The Geography of Hudson's Bay: Being the Remarks of Captain W. Coats, etc., *Hakluyt Soc. Publs.*, 1st Series, Vol. 11, London, 1852, p. 66.

improbable to them, since the islanders migrate across the field ice once a year to trade at Great Whale River Post and consequently are not unknown to them.

Low in one of his reports[7] refers to a projected exploration of the Belcher Islands that was not carried out. Probably he, too, had received interesting

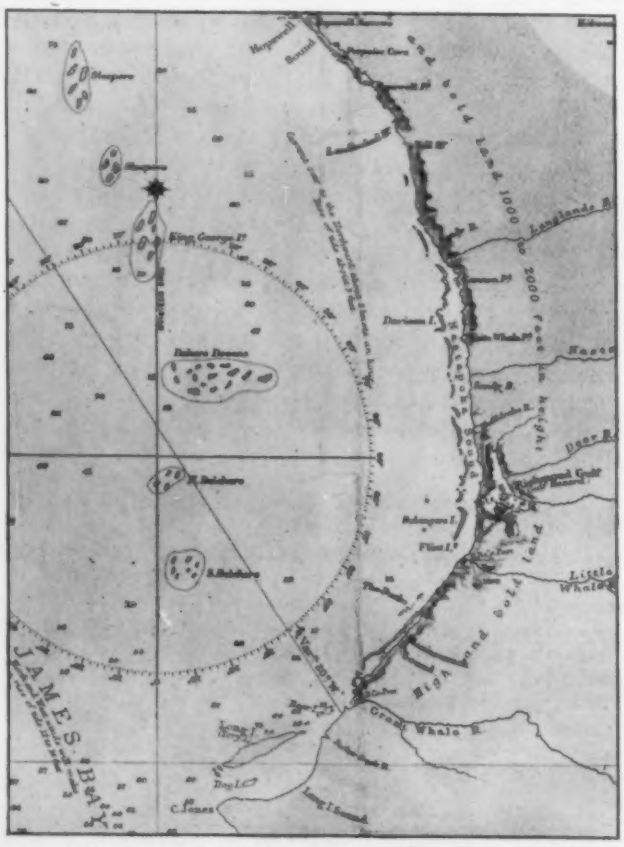


FIG. 2—Section of British Admiralty Chart No. 863 ("Hudson Bay and Strait," mean scale 1:2,100,000, published 1884, 5th edition, 1910) showing current representation of the Belcher Islands. Scale of this reduction, 1:3,300,000.

information from the natives concerning them. The reference is of interest as evidence of the ice conditions that may obtain in the bay during the summer months.

At Great Whale River we were again delayed by ice until the 7th of July, when we were advised by all the Eskimos to abandon our proposed trips to the Belcher islands, which lie about seventy miles off the coast and about which, owing to the prevalence of

[7] The fourth listed in footnote 3; reference on p. 41.

westerly winds during the early summer, the ice would be very thick. This advice proved correct as the Hudson's Bay Company's ship "Lady Head" was beset with heavy ice as far south as Bear Island in James Bay, where the ice was left on the 20th August.

FIG. 3—Copy of a portion of a map from Drage's "An Account of a Voyage For the Discovery of a North-West Passage by Hudson's Streights . . . Performed in the Year 1746 and 1747," 2 vols., London, 1748-49, showing Hudson Bay and Strait as represented in 1662. Note the large islands in the east-central part of the bay.

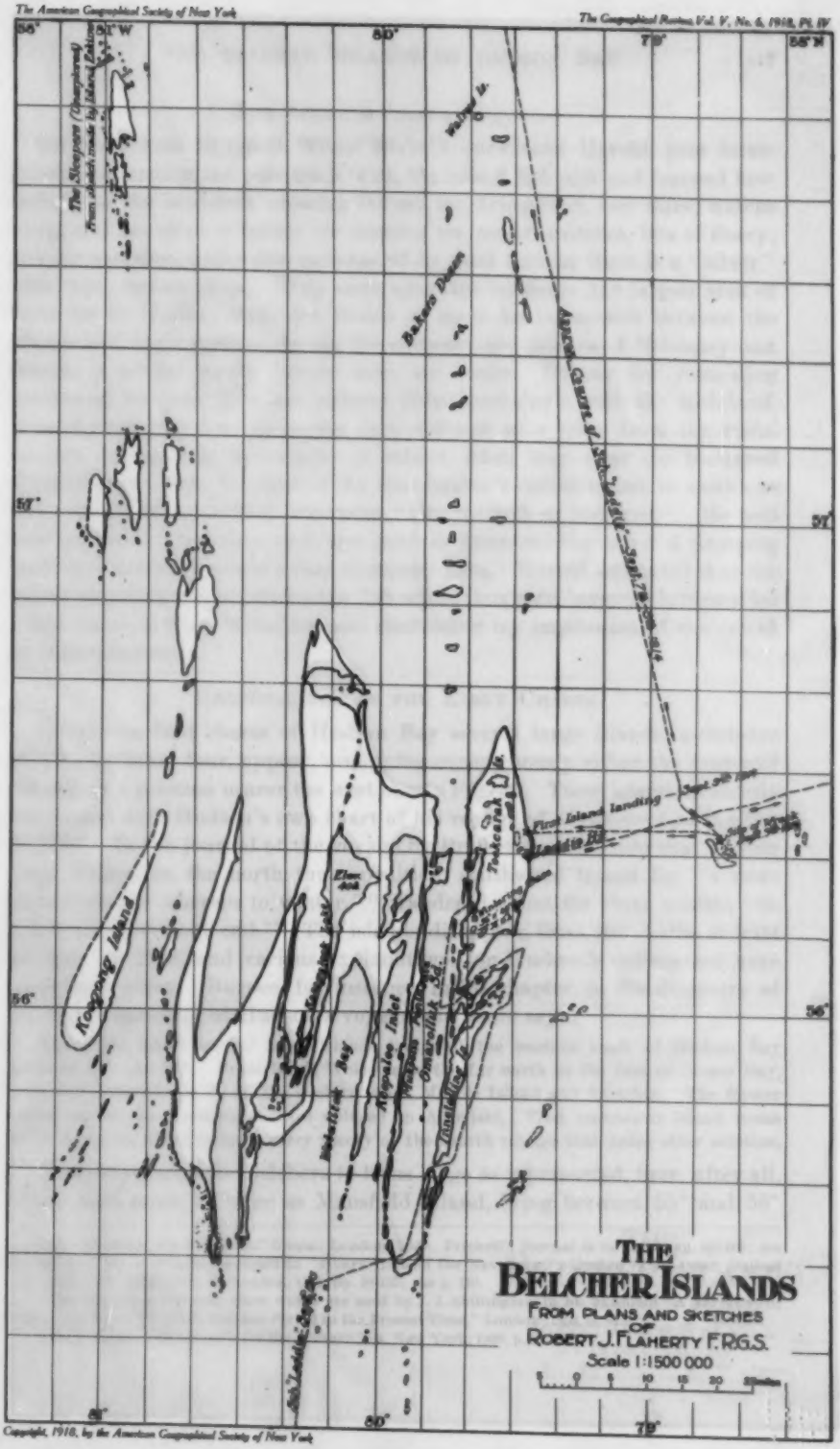
Probably, also, he had in mind Dr. Bell's remarks on certain rock specimens supposed to have been broken from the fixed rocks of the Belchers and his belief that these specimens indicated the extension to the Belchers of the Nastapoka series.[8]

[8] Robert Bell: Observations on the Geology, Zoölogy, and Botany of Hudson's Strait and Bay, made in 1885, Report DD of *Annual Rept. Geol. Survey of Canada*, Vol. 1 for 1885, Montreal, 1885, p. 14.

The islands further out to sea, opposite to this part of the coast, are also believed to consist of rocks of the Manitounuck [Nastapoka] group. Specimens, said to have been broken from the fixed rocks of the Belchers, opposite Little Whale River, were obtained

FIG. 4—Facsimile of a map of the Belcher Islands by Wetalltok, an Eskimo. The original is drawn in pencil on the back of an old missionary lithograph and measures 13¾ by 12¼ inches. Comparison with the true outlines opposite (Pl. IV) shows how remarkably accurate the Eskimo map is. In its grasp of the intricacies of the island system this map is a specially noteworthy example of its kind. For some other Eskimo maps see "Narrative of the Second Arctic Expedition Made by Charles F. Hall," edited by J. E. Nourse, U. S. Naval Observatory, Washington, 1879, facing pp. 351 and 354 (eastern coast of Fox Basin), and F. Boas' "Central Eskimo," *6th Annual Rept. Bur. Amer. Ethnol. for 1884-85*, pp. 643-647 (Cumberland Sound and Frobisher Bay, Baffin Island).

at my request from the Eskimo and are found to consist of amygdaloid, white and grey dolomite, a soft grey schist, and columnar calcspar, the last named apparently from a thin vein.



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The Belcher Island Eskimos

On the return to Great Whale River I questioned Harold, post interpreter, concerning the post trade with the island Eskimos and learned how every year the islanders, crossing the sea ice, bring bear, seal skins, walrus ivory, and fox skins to barter for tobacco, tea, sugar, matches, bits of finery, powder and shot, and a gun perhaps, if by good fortune there is a "silver" (fox skin) among them. They cross when the ice fields, the largest area of fixed ice in Hudson Bay, are frozen so as to be immovable between the islands and the mainland during the extreme cold months of February and March, a period rarely longer than six weeks. During the remaining months of the year they are isolated from intercourse with the mainland. Harold described how distinctly they differed as a tribe from the mainlanders, not only as to costume in winter, when they wear the feathered skins of eider ducks in place of the mainlander's deerskin, but in speech as well; which, he explained, was more "like the talk of children." He told how primitive they were and how poor as hunters—the latter a damning fault in Harold's Hudson's Bay Company eyes. Harold estimated that the island population numbered some 150 souls, thus corroborating information I had received from Wetalltok and confirming my impression of the extent of their territory.

Uncertainties of the Early Charts

On the earliest charts of Hudson Bay several large islands, sometimes three, sometimes four, appear, occupying conspicuously either the center of the bay or a position nearer the west coast (Fig. 3). These islands evidently originated with Hudson's own chart of his voyage of discovery into the bay in 1610. In the journal of the voyage by Prickett[9] we are told that leaving Cape Digges on the north the expedition, southward bound for "a more genial climate wherein to winter,"[10] wandered about for three months "in a labyrinth without end." The islands disappear from the charts at least as early as 1709, and various explanations for Hudson's delineation have since been given. Burpee, for instance, in his chapter on the discovery of the bay,[11] speaking of Hudson's voyage and chart says:

> The chart shows several large islands lying off the western coast of Hudson Bay between 56° and 60°. From Roe's Welcome in the far north to the foot of James Bay, only two large islands lie off the western coast, Marble Island and Akimiski. The former being out of the question, we are reduced to Akimiski. That convenient island seems to be a peg on which to hang every theory of the fourth voyage that defies other solution.

Now, supposing the Belchers to be as large as represented, here, after all, was a land mass, as large as Mansfield Island, lying between 55° and 58°

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[9] In "Purchas, His Pilgrimes," 5 vols., London, 1625. Prickett's journal is in Vol. 3, pp. 597-609; see pp. 600-601. The journal is reprinted in "Henry Hudson the Navigator," edited by G. M. Asher, *Hakluyt Soc. Publs.*, 1st Series, Vol. 27, London, 1860, pp. 98-135; see p. 110.

[10] Paraphrasing Prickett, these words are used by J. J. Shillinglaw in his excellent "A Narrative of Arctic Discovery From the Earliest Period to the Present Time," London, 1850, p. 88.

[11] L. J. Burpee: The Search for the Western Sea, New York, 1908, p. 21.

in approximately the latitude of Hudson's islands. Might they not, then, present a solution of the problem at least as reasonable as any of those already put forward? Supposing, also, Dr. Bell's belief as to the extension to the islands of the Nastapoka rock series to be true, and the native representations as to their size to be even approximately correct, here, indeed, was a field of promise in the economic sense and a fascinating one as well from an ethnological and geographic point of view.

The Second Expedition

By June of the following year, 1911, the expedition was under way. I again arrived, this time by the Missinaibi route, at Moose Factory and there secured a thirty-six foot sailing craft for the cruise to the islands. To make a long story short, our little craft proved inadequate for the work in hand, and we arrived at Great Whale River post too late to impress a crew for the crossing. Wintering at Fort George, therefore, I waited eight months for an opportunity to cross over the sea ice from Great Whale River, but was again doomed to disappointment when, on the point of making departure with two Eskimos, the field ice broke, disrupted by an extremely heavy gale, an occurrence unique in the twenty-eight years of old Harold's experience.

All thought, therefore, of reaching the islands was abandoned for the remainder of the winter and until the following open season. Whereupon, following an idea that had been shaping itself in my mind, I planned to explore an ore-bearing rock series, similar in character to the Nastapoka series, reported by A. P. Low as occurring along the lower reaches of the Koksoak River in northeastern Ungava, 100 to 150 miles inland from Ungava Bay. I hoped to find an extension of that series farther north on or near tidewater of southwestern Ungava Bay. The undertaking involved two traverses across northern Ungava through the hitherto unexplored portion of the peninsula; the first by sledge along the 57th to the 59th parallels eastward from White Whale Point on Hudson Bay to Leaf Gulf on Ungava Bay; the second by canoe along the 60th parallel westward from Payne Bay on the Ungava seaboard to the mouth of the Povungnituk River on Hudson Bay. The second traverse was undertaken only when I found that the return journey I had planned ascending the Koksoak River to the height of land, thence by the headwaters of the Great Whale River to Hudson Bay, would, in any event, owing to the unusually late break-up of the Koksoak River, bring me too late on the Great Whale seaboard for the crossing I had intended making that summer to the islands.[12]

The Third Expedition

So it happened that in October, 1912, a year and seven months after leaving civilization, I again arrived in Lower Canada with the expedition

[12] An article by the writer on his two traverses of Ungava Peninsula will appear in a forthcoming number of the *Review*.—Edit. Note.

to the Belchers still unaccomplished. However, with a persistence altogether characteristic, Sir William said, "Get a ship." This meant outfitting on an adequate scale at St. Johns, Newfoundland, and proceeding through Hudson Strait and southward along the eastern coast of Hudson Bay. Accordingly the topsail schooner *Laddie*, of 83 tons register, was purchased from Captain Sam Bartlett, the well-known Arctic navigator of Brigus, Newfoundland. Captain H. Bartlett was put in command. The crew were: S. Gushie, mate; H. Spracklin, boatswain; McLeary, engineer: W. Robertson, cook; and R. O'Leary, K. French, and J. Robertson, seamen. S. Sainsbury and E. E. Laduke completed the personnel of the expedition.

Though we cleared St. Johns on August 17, 1913, it was not until a year afterward, late August of 1914, that we finally put into the bay. This was on account of our delayed departure from Newfoundland, which brought us so late into the strait that we were stopped there by winter. Winter quarters were erected in Amadjuak Bay on the south-central coast of Baffin Island, and the ship was sent back to Newfoundland with orders to return the following year over the first open water. During the year we carried out explorations along the seaboard. An attempt was made to explore the unknown coast line of Fox Channel;[13] but an inadequate outfit and impassable rough ice made the project impossible, and at the Trinity Islands, 35 miles west of Cape Dorset, we were turned back. A small portion of the interior of southern Baffin Island was explored as far north as Amadjuak Lake. We compiled an ethnological collection for the Royal Museum of the University of Toronto, and with a motion picture outfit filmed the travel and igloo life and some of the religious performances, conjuring, and dances of the Baffin Island Eskimos.

The *Laddie* was six weeks *en route* to our relief, having encountered heavy ice all along the northern Labrador coast and at the entrance to Hudson Strait; in the strait she was nipped in a heavy ice stream which came near sinking her. On the 19th day of August, when we were living on the fag ends of our provision supply, she finally arrived, somewhat bruised at the bow and with a bent propeller shaft, but not beyond repair; and on the 23rd of August we set sail for Hudson Bay.

Arrival at the Islands

From Cape (Sir Thomas) Smith a course was laid due south and off shore some seventy miles. In latitude 59° we encountered thick, foggy weather, which was continuous to 56° 30′. We had sighted small islands, barren, low masses of trap, all of them less than two miles in length, whose outlying waters were shoal and infested with innumerable reefs. Fearing accident, toward nightfall of September 8, the ship's course was laid to

[13] All such attempts are to be welcomed, as, for the representation of this not inconsequential feature of Arctic geography, we are still dependent on the Eskimo maps of 1868 procured by Hall on his second expedition. Cf. title of Fig. 4.—Edit. Note.

FIG. 5—Wintering base on Belcher Islands, May 25, 1916. View looking westward across Omarolluk Sound. (Figs. 5-14 from photographs by the author.)

FIG. 6—The northwestern part of Tookcarak Island: looking along the strike of the rocks. Exposure of marl in the foreground.

eastward for sea room over night, but within the hour she grounded on a sunken shoal, where she pounded heavily through the night. When daylight came we made out through the lifting fog a small island a half mile to westward, while to the northeast, the east, and the southeast lay a nest of boiling reefs.

Contrary to our expectations of total wreck, at noon, by aid of the tide and the discharge of her ballast and oil fuel, the *Laddie* hobbled off unhurt. Our good fortune did not end here, for the watering crew, taking the ship's casks ashore to refill them, climbed a low hill of the small island's northern end and from its vantage saw land to the west extending north and south over nine points of the compass and distant approximately twenty-five miles; obviously it was an island seaboard at least sixty miles in length—identifiable only as the eastern coast line of the Belchers.

That evening we arrived at the northerly extreme of the island, logging twenty-two knots for the distance. From the crest of the shore range, a bold island-free coastline of barren, ice-scoured diabase descending some 250 feet half roundedly like a whale back into the sea, we gained a view of unbroken ranges of land to the westward, barren save for plots here and there of russet mosses, studded with tiny lakes, and extending inland to a horizon twenty miles away, and here, typifying as strikingly the topography of the country as do those of the Nastapokas and the mainland, lay the Animikies—first the coastal eruptives, and beyond them the red bands of shale and marl, the yellow of the quartzites, and the white gray of limestone, all paralleling north-northeast and south-southwest, the trend of the island generally.

A week was spent along the island's east coast. Six miles to southward of this first anchorage we entered a snug bottle-necked harbor, and, while the crew reballasted the ship and did such overhauling as under the circumstances was possible, we made crosswise trips inland and a launch cruise to the southward, covering short distances only, however, since we found the ore series we were looking for on the shores of the harbor itself, and detail work upon it consumed most of our time. We kept a sharp lookout for natives, but none were seen; though recent fire places, boulders, and old goose blinds were noted at several points along the shore.

Return to Great Whale River Post

Embarrassed by the unseaworthy condition of the ship, on the morning of September 13 we cleared the islands, southward bound, to berth her for the winter at Moose Factory. At Great Whale River post the expedition instruments and gear were discharged and stored away against our return islandward the following open season.

Strangely enough in the interval of my last visit to Great Whale River there had been brought to the post by one of the Hudson's Bay Company's employees, as a curio from a far-out post east of southern James Bay, an

old post copy of company correspondence—letters of Sir George Simpson, governor of the company, and of his factors on the bay during the years 1846-1849. These letters contained, besides routine business matters, a project for sending to the Belcher Islands, in order to open up trade with the inhabitants there, a half-breed servant of the company, Thomas Wiegand by name, with Eskimo companions. The letters relate how Thomas Wiegand carried out this project, making two trips to the islands, as given in the following reports of his expedition.

Letters Relating to Thomas Wiegand's Visit to the Islands in 1847-48

Extracts from a Letter from John Spencer, Fort George, dated July 9, 1847, to Mr. Jos. Gladman (Chief Factor)

. . . . . Conformable to your wish I sent Thomas Wiegand and those that I mentioned to accompany him to the Esquimaux Islands on the 3 March & they took their departure soon after the Ruperts Ho: men went off from here; but in consequence of the rough state of the Ice, accidents with the sled, and bad weather they were 7 days in crossing from Land to Land. Tom suffered a good deal from cold & the change in the mode of life which was natural to be expected, and the want of fresh water was a great privation to him, for the snow he was forced to make use of was completely saturated with the salt water rime which brought on severe dysentery Complaint. He saw but 5 Esqx at the Island he went to, as the rest had some time previously taken their departure to the northward with the view of hunting the Sea-horse at the Sea Horse Islands . . . . .

However, the purport of this Trip was not so much for Trade as for ascertaining the lay of the Islands which Tom has now thank God so far ascertained as well as the position of an harbour for the Vessel, which is as far accomplished as a winter Survey would reasonably allow of, he has moreover given them instructions to be upon the lookout for the Sloop about a certain time of the year and Should she make her appearance for them to make a Smoke &c &c to say nothing of Land marks they are directed to set up. It must be necessarily the lapse of another twelve month before the more distant Indians [Eskimos] can receive the Glad Tidings thats in contemplation for them which no doubt they will be very happy to hear of. Altogether I should say the Trip augers [*sic*] favourably for future enterprise and time with patience are two of the Ingredients required for us to wrestle with in bringing things about as it will [be] a most desirable object to see those Islands by open water when every thing its to be hoped will appear to better advantage than when under the course of Snow & Ice . . . . .

Extracts from a Letter from John Spencer, Fort George, dated Jan. 8, 1849, to Jos. Gladman, Esq.

. . . . . At all events he [Thomas Wiegand] succeeded in accomplishing a very important object in his visit to the Esquimaux Islands having neither met with obstructions from Ice or shoals and when arrived there he met with the shelter and security of an excellent Harbor; Objects of no trifling consideration to the explorers of a strange Coast—And although it so happened that he saw but few Natives and got but little from them it would be highly ridiculous in endeavoring to make that appear as a sufficient reason for not going again, and that their poverty should for a moment be thought sufficient for framing such an Idea, an Idea in itself as absurd as it is ridiculous and could only find shelter in a narrow mind, for after our Knowledge of those Islands being more or less inhabited, and that those Natives are living under no other protective hand than that which nature bestowed upon them; indifferent should we be

considered in our endeavor towards bettering mankind were we to shew ourselves indifferent towards them; and the more so when we seriously reflect on their present condition and coupling with it the short distance at which they reside from European aid—I think the three first objects above cited are of themselves a sufficient reason as well as consideration for future enterprise even chilled as the minds of the Crew were at the solitude of the place which in itself ought to form but a secondary consideration when exploring the regions of so inhospitable a portion of the Coast—what is it to them whether the ground be covered with luxuriant verdure and every thing around cheerful and pleasing; or for them to find it as they did, provided they are blessed with a good harbor when arrived there; and by concerting measures hereafter who Knows but the inhabitants of these Islands may be brought to furnish a valuable portion of Trade in Blubber, Foxes, Ivory and what not—All such matters have yet to be tried and if we cannot succeed it will then be time enough to relinquish the thing, and at the present moment I have no doubt but they view the Trip over there with a degree of unpleasantry altogether Ideal. . . . . For my own part I think all was done that could be reasonably expected of them, and the circumstance of the poor trade they met with I look upon as nothing just now—they succeeded in getting there and very smart too, they found a good harbor and these are grand objects; and its now for us to endeavor to do the needful in establishing among the Inhabitants of these Islands a perfect understanding of an annual visit from us for the purpose of Trade (Weather and circumstances permitting) and to endeavor to set them on a footing that will be worth while for us to go there, adding as it will to their comfort and convenience under a Hope from ourselves that such intercourse will ultimately prove beneficial to the concern . . . . .

General Results of our Third Expedition

That this estimable scheme for mutual benefit, however, was not to be realized is apparent from the fact that the islands so soon and so completely drop out of Hudson Bay tradition. None of the letters gave any evidence as to their size. Our own testimony to the extent of the land we had seen was received both at Great Whale River and elsewhere on the bay with open skepticism and no little "pleasantry" on the part of Company men whose life's experience had been along the Great Whale seaboard.

We arrived at Moose Factory on October 2, and there experienced an aftermath of the island shipwreck, when the *Laddie*, discharged of her ballast and gear, filled to the engine room, but settled, fortunately, on a shallow river bar, over which she lay at anchor until berthed.

Fourth Expedition

After spending the winter in the confines of civilization we again reached our field of operations in September, 1915, when the *Laddie* again dropped anchor in the shelter of a Belcher Island sound. On this, our second visit to the islands, the explorations were carried on continuously through the winter and summer until the following September. They were as comprehensive as the limited resources of the expedition in men and means permitted, for only the ship's master, W. Robertson, and a Moose Factory servant, to both of whom I am deeply indebted for what was accomplished, remained with me through the winter and following summer. The remainder of the crew were sent out in October and February owing to our

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 7—Looking westward (8 miles) across Wetalltok Bay.
FIG. 8—Kasegaleek Lake: looking northward from 10 miles beyond its southern end. May, 1916.
FIG. 9—Kasegaleek River, the discharge of Kasegaleek Lake (at its southern end).

lack of fuel and provisions. By mid-March our fuel had become exhausted, and the *Laddie*, now crewless anyway, became the victim of circumstance and afforded us a fuel supply by her masts, yards, bowsprit, rails, and cabin —all of her in fact that was combustible. The following open season's work and the final journey from the islands were carried out in the *Nastapoka*, the same diminutive craft we had attempted to use in our first futile effort to gain the islands from Great Whale River on our second expedition.

Topography and Structure of the Islands

The original map of the islands accompanying this article (Pl. IV) is a compilation from the maps we made as we traveled across country by sledge in winter, and along the coast by boat in summer. Though only approximate—distances were reckoned by odometer and log—it gives a fair idea of the extent of the islands and should be of use to those who may eventually chart them by detailed survey.

As the map shows, the islands cover an area of more than 5,000 square miles, having an extreme length north and south of 91 miles and an extreme width of 57 miles. The reader will note the peculiar outline of the islands, the consistent trend of sounds, indentations, bays, and inlets. The island ranges also, barren hills, the highest of them not more than 480 feet as determined by aneroid, lie like bands of rounded ribbing, paralleling the islands' trend. This is typical of the Animikean rocks, which were found everywhere to comprise the rock system. Eruptive diabases, extending over a third of the islands' surface area, include the more prominent of the ranges and are distinguishable by their conspicuous brown black appearance, by their generally more barren condition, and by their massiveness. They form a striking contrast to the sedimentaries, which lie in folds, synclines and anticlines, dipping east or west, as the case may be, at an angle which varies from 50° to 5°.

Owing to the absence not only of tree growth but also of soil, except where to a local extent it occupies the floors of valleys, the rock formations are everywhere so well exposed that with a field glass from a distance of six miles or more we were able to locate the white bands of quartzite, the reddish masses of the ore series, and the jet-black hills of the eruptives. This absence of trees and soil was a factor in facilitating exploratory work whose value can hardly be realized by one not familiar with such conditions.

The Lakes

Throughout the interior of the larger islands lakes are everywhere found. They range in size from goose ponds and pools in the peaty tundra of the valleys to the magnificent Kasegaleek Lake (Lake of Seals). The smaller lakes are generally shallow; in many the ice freezes to the bottom, that is to a depth of six feet. The lakes not thus frozen in winter contain an abundance of Arctic salmon and whitefish, the only species of fresh-water

FIG. 10.

FIG. 11.

FIG. 10—Occurrence of iron ore and jasperite raised by frost action above ground level (indicated by the snow patches).

FIG. 11—Typical moss valley and barren diabase hill in distance.

fish found and an important source of the islanders' game supply during the open year until the middle of December. Kasegaleek Lake, 43 miles in length and, on an average, 7½ miles in width, occupies the largest and central island of the group. It lies some 40 feet above sea level and discharges from its southwestern extremity through a small river 10 miles in length. This river is broken into a series of lake expansions and descends by rapids, none of them too rugged for kayak travel, to the sea. A mile from its mouth it is 200 feet wide, has an average depth of 4 feet, and a current flowing at the rate of 3 miles per hour. The eastern shore line of the lake is composed of almost sheer rugged cliffs and steep hills of diabase, averaging 150 feet in height and extending nearly the entire length of the lake. On the lake's northeastern portion, a U-shaped bay extends eastward to within 1,500 feet of tide water, to which, through a canal, the water of the lake could easily be led, with a fall of 40 feet.

The western shore of the lake is less rugged and is broken by islands and long-fingered indentations which run parallel to its length. The islands increase in number to southward, being most numerous in the southwestern portion. The natives say that the lake is extremely deep. Unfortunately I had neither time nor opportunity to make soundings. Innumerable pools and small lakes on the islands and throughout the low tundra of the western shore are breeding-grounds for geese during the months of May, June, and July. At this season the natives come there to hunt them, to gather eggs, and to fish for the Arctic salmon which then are spawning in the gravels along the shore line and in the mouths of entering streams. Here also they hunt the fresh-water seal, with which, they assert, the lake abounds; hence its name. Its clear, green water, hemmed in by the jet walls of rugged shore, with a traverse that extends to a landless horizon when viewed from either extreme, forms, despite the dearth of trees and vegetation, a picture that is singularly beautiful.

Navigation

Good harbors, ranging from sounds to small and snug bottle-necked anchorages, occur throughout the islands. With proper charting, the approach from sea, save along the southwestern coast, should not be at all dangerous. The season of open water varies greatly, however. During the year of our residence the field ice cleared on June 10 and did not return again during the summer. We gathered that this was a very unusual occurrence and was due to the prevalence of northerly winds during May and June when the sea ice was rotting and being broken by the tides. The Eskimos say that in some years the islands have been surrounded by pack ice as late as mid-August, and that ordinarily the annual clearance occurs about the first week in July. For ships built for the navigation of Hudson Strait the average date of approach to the islands should be approximately the first week in July, if not earlier, since much of the field ice, if

still existent, would then probably be rotten enough to offer no obstacle. Obviously only ice observations covering a period of years can yield results of definite value.

Climate

The climate of the islands differs widely from that of the opposite mainland. Compared with weather reports from Great Whale River for the same period, our observations gave a far greater proportion of overcast skies and fogs, stronger and more constant winds, but higher and more equable temperatures. From October till early December winds of a velocity up to 50 miles were almost constant, and the sky was continuously overcast.

No snow covered the ground permanently until November 15, and no ice was formed in the small lakes near the wintering base until December 4, when the long period of winds ceased and a fortnight of calm, clear weather set in. The mercury did not fall below zero until January 2—a weather condition without precedent in my experience of the North. Great Whale River early in December had a minimum temperature of —30° and recorded a constant average for the period well below zero.

On January 2 winter commenced in earnest. The month was characterized by constant drifting winds of a maximum force of 70 miles; calm days were unknown; and the average temperature was —16°. In February the winds abated; there were many days of sunshine, a few of them almost calm. The average temperature for the month was —19°. Throughout March strong winds again prevailed; by the end of the month the snowfall for the winter had reached its maximum, 4 feet; the average temperature for the month rose to —9°. In April and May there was the usual prevalence of wind, and several blizzards occurred, each covering a period of from one to two days. In the latter part of May the weather broke and became warm and summery; in fact, there were heavy thunderstorms at this time. On May 28 sledging over the ice fields was at an end, and by June 10 the field ice surrounding the islands had blown off to southward. Then commenced the most trying time of the year; for hardly two days together did fair weather obtain. From mid-June onward to the time of our departure on September 13 exceedingly heavy gales of wind of from one to three days duration occurred in every week. The prevailing direction of the winds was south-southwest for not only that period but for the entire year. Days of sunshine were rare; the sky was generally overcast; and rains, accompanied usually by heavy south-east winds, were frequent. According to the natives the weather we experienced during that year was not at all typical; usually, they said, the winds were fewer and less violent, and the temperature during the winter was lower. The remarkable lateness of the freeze-up (December 23) was, they said, without precedent. The minimum temperature for the winter was

—48° as compared with the lowest mean reported temperature on the mainland of —55°. The maximum thickness of fresh-water ice was 5½ feet, and of sea ice 5 feet. The maximum temperature for the summer, occurring on July 25 at noon, was 70°.

Plant Life

The plant life of the islands, typically subarctic, like that of the mainland comprises the Arctic white and gray lichens and mosses, the stunted northern willow, the dwarf birch, and flowering plants. Before the snow has altogether disappeared in late June banks of anemones—solid masses of color, yellow, purple, and white—and waving plumes of wild cotton lend the moss-carpeted valleys the aspect of cultivated fields.

At least six varieties of edible berries are found; they are for the most part ripe by mid-July and occur wherever the mosses grow plentifully. All of them are much prized by the Eskimos and form the only vegetable portion of their otherwise exclusively meat diet. First in importance is the cranberry, chiefly valuable because of its keeping quality and its medicinal value as an antiscorbutic. The Eskimos, however, unlike the Indians of the Ungava interior, do not gather the berries for storage through the winter.

Animal Life

Compared with that of the mainland, the animal life on the islands is more typically arctic. Here the black bear, beaver, otter, wolf, wolverine, marten, ermine, and fisher are unknown, and the only species common to the country along and south of the timber line are the colored foxes. The various species of seal, cited in the order of their importance from the point of view of the natives' food supply, are: the ringed seal, the square flipper, the harp (rare), and the fresh-water seal. Walrus, hunted at various points on the most northerly outliers of the islands, are found there in large herds during the open season.

Till within the last thirty-five years or so there grazed on the islands large herds of Barren Ground caribou. In one portion mounds of their bones can still be seen. The natives explain their disappearance as the result of heavy rains followed by a cold wave which froze the moss and lichen plains into a vast glaze of ice so that the caribou, their food supply rendered inaccessible, all perished from starvation. At about this same time, however, the mainland herds also disappeared, changing their migration to the eastern slope of the Ungava Peninsula, since which time they have never as a herd reappeared along the Hudson Bay slope south of 60° N. This shifting of the mainland migration is the more probable explanation of the disappearance of caribou from the islands, particularly when one considers the ease with which they could cross the field ice connecting the islands with the mainland in winter.

The white whale, or porpoise, is found in large schools during the open

season throughout the island sounds and larger indentations. Its flesh is highly prized by the natives, as is also the oil. The hide furnishes a high quality of leather.

The right, or bowhead, whale is not known, though it ranges as far south as the Ottawa Islands in 60° N., where the Scotch whaler *Active*, of Dundee, has twice wintered. We found the carcass of one, probably killed by the *Active's* crew, on a small outlier northeast of the main islands. The sight of it was a novelty to the natives who were with me at the time.

Polar bear are found most plentifully when the coast is icebound, or when large areas of field ice surround the islands. In summer they are rare. We saw none during our exploration of the country, and less than six were killed by the natives during that period.

Of the foxes—white, red, cross, silver, and black—the white, or Arctic, is more numerous than all the other species together. The blue fox is also found, but more rarely. Arctic hare are not plentiful. Of the small rodent forms the Hudson Bay lemming is the most common.

Bird Life

Of the birds on the islands, which, with their eggs, constitute an important source of native food supply during the breeding months from mid-May to mid-July, sea fowl are, of course, the most abundant. They are represented principally by the eider duck, first in importance as game; the black duck; the glaucous and, more rarely, the ivory gull; the black-throated and the red-throated loon; the plover; the yellowlegs; and the sea pigeon, found in large rookeries on certain small rocks outlying from the main island group. The Canada goose breeds on the islands in large numbers, the first arrivals coming on or about the last week in April; and with the southward migrations in September and early October comes also the wavey, and sometimes the brant. Rock ptarmigan are not plentiful.

Population

The Eskimos native to the islands are called Kittoktangmiuts, or "islanders," in distinction to the Itivimiut, or mainland, tribe. Of these there are not more than five families, the remainder of the population, twenty families or so, being made up of mainlanders who, attracted by the walrus grounds and sea-fowl rookeries and outlawed in some instances by their own people, have from time to time emigrated to the islands. The tribes are not radically different. The most noticeable difference between them is not so much the dialect as the manner of speaking. The islanders speak more slowly; as Harold aptly expressed it, they have "the speech of children."

Since the disappearance of the caribou from the islands the population, for want of deerskin, has had recourse for clothing in winter to the feathered

skins of eider duck and sea pigeon (Figs. 12 and 14). These materials are inferior in wearing quality, heavier, and too warm for even the coldest weather; furthermore, to the white man's nose at least, they are most obnoxious. The summer clothing, fashioned according to custom principally from sealskins, is not distinctive; nor are their implements, sledges, and kayaks different from those in use on the mainland.

FIG. 12—A Belcher Island Eskimo boy in eider duck costume. Skins reversed, feathered surface inside. The boy's left cheek is frozen.

The services of many of the people were utilized during our wintering in connection with exploration work. Their aid proved invaluable. They took a real interest in our iron ore exploration, particularly when we pointed out that their guns and knives were made from iron ore. We taught them to apply the test for hematite by scratching specimens for a characteristic red streak, and many of the ore occurrences that we explored were first found by them.

During the winter we compiled a series of motion pictures, showing the primitive life, crafts, and modes of hunting and traveling of the islanders—an improved version of the film we had previously made on the Baffin Island expedition. With a portable projector brought for the purpose we showed the islanders a copy of the Baffin Island film, purposing in this way to inspire them with that spirit of emulation so necessary to the success of our filming. Nor were we disappointed. Enthusiastic audiences crowded the hut. Their "Ayee's" and "Ah's" at the ways of these their kindred that were strange to them were such as none of the strange and wonderful ways of the *kablunak* (white man) ever called forth. The deer especially ("Tooktoo!" they cried), mythical to all but the eldest among them, held them spellbound.

Indeed for the co-operation of the people we had reason to be grateful throughout our stay with them. To their daring as kayakers, surpassing that of any other Eskimos of my acquaintance; to their knowledge of ice fields and their "working"; and to their craft and skill at winter traveling, we in great measure owed the safety and success of various undertakings.

Their honesty was the honesty we had learned to admire in the Baffin Island Eskimos, with whom we had lived under the same conditions of

trust. For we had a trade outfit, apart from expedition supplies, which we used in paying the natives for services in film work and exploration, for dogs and dog driving, and for such game as they could furnish at various times through the year; and this material, several tons of it, consisting of flour, pork, sea biscuit, grease, sugar, tea, tobacco, cheap candy, finery, knives, axes, files, Winchester .44 carbines, powder and shot, nails, and bits of hardware—a treasure trove in the native eyes—was housed in ten-by-twenty-foot tents and, though easy of access to any who might wish to help themselves, was never once molested.

FIG. 13—A Belcher Island Eskimo woman, aged about fifty years.

MINERALS

Our mineral explorations resulted in the discovery of four distinct ranges of iron-bearing rocks, 30 miles in length and 3 miles apart, one from another, in an east-and-west direction, on the eastern half of the islands. The longest continuous outcrop found was 4 miles in length, with an average width of the ore body—if such it may be called, for it is a mixture of ore, jasper, and much other siliceous material—of 30 feet. This outcrop is the northern extremity of a range which follows for 25 miles the eastern shore line of Keepaloo Inlet. Here from what is the western edge of an enormous syncline the ore series dip 40° to eastward and underlie Omarolluk Sound, 5½ miles across to its eastern shore, where the eastern edge of the fold is found, though in much leaner state and less exposed at surface. These figures may convey to the reader some idea of the magnitude of the largest of the iron ore deposits. No ore of high quality, however, was found. The best, in Keepaloo Inlet, averaged from wall to wall not more than 38 per cent metallic content—obviously too low-grade a product for present operation in these latitudes. The principal detriment to the ore is silica; as far as phosphorus is concerned it is fairly clean, averaging less than .005 per cent.

In certain contacts between the silicified limestones and diabase on the western slope of Tookcarak Island were found occurrences in small stringers of calcite, of smaltite, and of cobalt bloom. There was no body of calcite, and the distribution of the minerals where found was sparse. Other minerals noted were manganese, occurring in small stringers in iron-bear-

ing slates and chalcopyrites, some of the latter mineral containing as much as 30 per cent of copper. Neither mineral was found in commercial quantity, however.

Other Expeditions

In August, 1916, the writer's father, R. H. Flaherty, M.E., Dr. E. S. Moore, professor of geology in the Pennsylvania State College, and W. H. Howard, Dominion Land Surveyor, arrived on the islands. Dr. Moore and Mr. Flaherty made geological and mining reports on the expedition discoveries. Dr. Moore also made a geological cross section of the folds of rock series over the eastern half of the islands. Mr. Howard's work comprised an accurate determination of the position of the islands in relation to known points on the mainland as well as some detail surveys in connection with Dr. Moore's and Mr. Flaherty's reports to Sir William.

Fig. 14—A Belcher Island Eskimo in eider duck costume. Feathers outside.

During the summer of 1915, that is the summer succeeding our first landing on the islands, the Hudson's Bay Company had made an expedition there with a local James Bay steamer and salvaged one of their sailing vessels which had been carried away by ice the preceding fall from Fort Churchill 500 miles across the bay. She had been reported to Mr. Mavor, the factor at Great Whale River, by migrating Eskimos, whereupon he had sent out his clerk, Mr. E. Renouf, a young Englishman, to verify the report. This Mr. Renouf did, crossing the field ice with two Eskimos, the first crossing over the ice to be made by a white man since Wiegand's in 1849. During our wintering Mr. Mavor and the Rev. Mr. Walton, missionary to the Eskimos of the Great Whale seaboard, visited me. All of this was the more interesting since the bay folk had been skeptical of Wetalltok's "Big Islands" yarn. The Big Islands are ancient history in the bay now, and Wetalltok stands vindicated.

THE GUATEMALA EARTHQUAKE OF DECEMBER, 1917, AND JANUARY, 1918

In December, 1917, and January, 1918, the city of Guatemala was practically destroyed by earthquakes. The following is the account of a prominent resident of that city, as given to Professor Marshall H. Saville of the Museum of the American Indian, Heye Foundation, New York. At the end Professor Saville continues the narrative and has added a few words of comment. For further information on Guatemalan earthquakes and their relation to the seismic activity of Central America see the works cited below.[1]

Two years ago, during the months of December and January, the city of Guatemala had been shaken by a series of severe earthquakes, lasting seven or eight weeks, and people by the thousands spent the nights in their courtyards or in the public parks and squares. These shocks, however, passed off without doing any considerable damage to the city, and this confirmed the Guatemalans in an ancient belief that their city, being almost entirely surrounded by deep ravines, was effectually protected against destructive earthquakes. A hundred and forty-five years ago the location of the city was carefully selected under the influence of this theory, and during all these years it had never been seriously damaged, while many other large cities in all parts of Central America were destroyed one after another. This unfortunate theory was also the reason why no thought whatever was given to earthquakes in our system of building. Only recently have a few concrete buildings and a few frame houses been erected by far-

[1] S. G. Morley: The Guatemala Earthquake [of 1917-18], *Amer. Museum Journ.*, Vol. 18, 1918, pp. 200-210.
———: The Guatemala Earthquake [of 1917-18], *Pan-American Mag.*, Vol. 26, 1917-18, pp. 305-317.
(Crichton Mitchell): Seismic Disturbances Connected With the Guatemala Earthquake, *Nature*, Feb. 28, 1918, pp. 514-515.
Tempest Anderson: The Volcanoes of Guatemala, *Geogr. Journ.*, Vol. 31, 1908, pp. 473-489, with map, 1:500,000.
Gustav Eisen: The Earthquake and Volcanic Eruption in Guatemala in 1902, *Bull. Amer. Geogr. Soc.*, Vol. 35, 1903, pp. 325-352.
F. de Montessus de Ballore: Temblores y erupciones volcánicos en Centro-America, 246 pp, San Salvador, 1884 (French version, Dijon, 1888).
Idem: Les tremblements de terre: Géographie séismologique, Paris, 1906, Chapter 21, Section 2: Le Centre-Amérique.
Karl Sapper: Die mittelamerikanischen Vulkane, 173 pp., *Ergänzungsheft zu Petermanns Mitt. No. 178*, Gotha, 1913.
Idem: Die geographische Bedeutung der mittelamerikanischen Vulkane, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1902, pp. 512-536.
Idem: In den Vulcangebieten Mittelamerikas und Westindiens, 334 pp., Nägele, Stuttgart, 1905.
Idem: Ergebnisse seiner Reisen in Mittelamerika, *Verhandl. Gesell. für Erdkunde zu Berlin*, Vol. 27, 1900, pp. 417-426, with map of tectonic lines of Central America, 1:5,000,000.
Idem: Grundzüge des Gebirgsbaus von Mittelamerika, *Rept. 8th Internatl. Geogr. Congr. Held in the U. S. 1904*, Washington, 1905, pp. 230-238, with map of tectonic lines of Central America, 1:5,000,000.

FIG. 1.

FIG. 2.

FIG. 1—Ruins of the church on the Cerro del Carmen, the oldest church in the city.
FIG. 2—Ruins of the church of Santa Teresa.

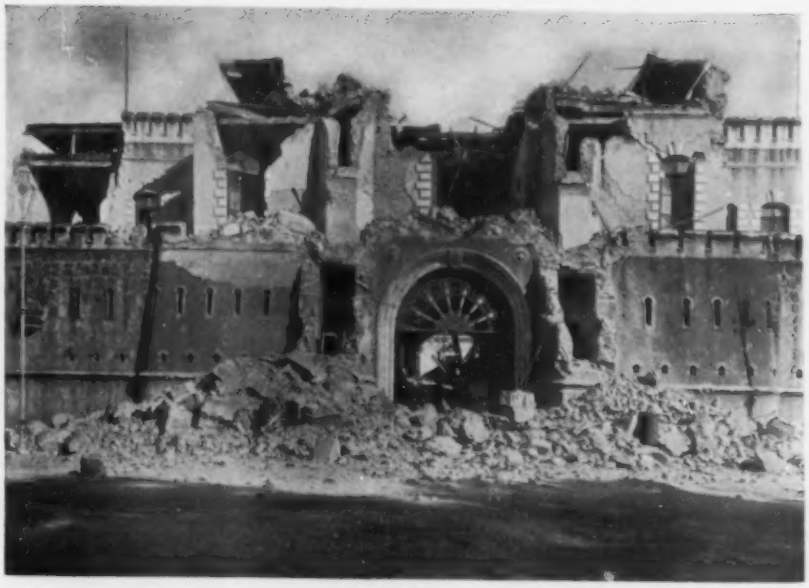

FIG. 3.

FIG. 4.

FIG. 3—Ruins of the Military Academy.
FIG. 4—Interior of a ruined church.

seeing persons. The rest of the city is built on shallow foundations, with weak walls of red brick or sun-dried mud, and heavy tile roofs, whose unsightliness was hidden by exceedingly heavy over-roof walls and cornices. So when a real earthquake caught us we were in no condition to resist it, and our childish theory was thrown to the ground together with our houses.

The present series of earthquakes began on November 17, 1917, with great severity, and kept on for three weeks, making small cracks in many walls and knocking down some top-heavy cornices. Then there was a lull till Christmas Eve. On that evening there was a severe shock, followed by several minor ones, all, however, of the kind to which we had been accustomed for generations. The great and unprecedented disaster was reserved for Christmas Day.

The Christmas Shock

At about 10.35 on Christmas night the town was aroused by a shock such as had never struck it before. The earth rocked like the sea for about a minute. The falling of furniture, the crackling of ceilings and roofs, and the swaying of walls were stupefying. Everyone immediately sought shelter in the streets though the cold was piercing. The electric lights were soon extinguished, but in the clear light of the full moon one could see the walls cracking and toppling, and the tiles thrown about in confusion on the roofs. The crowds stood about in their night clothes looking on in terror and helpless despair at the ruin of their homes and recounting their experiences. The earth trembled every few minutes, though less violently for a time; but about half an hour after the first great shock there followed another of equal duration and even greater violence. Houses swayed to and fro before our eyes, till the walls that had been cracked or shaken out of plumb came down with a crash, followed by ceilings and roofs. For a few brief seconds the rumbling of falling houses was mingled with the underground roarings of the earth and the suppressed moans and loud prayers of the women for mercy. Then all was still once more. The angel of destruction passed on, for his work was done, completely and thoroughly done, and in his wake lay the scattered ruins of the proud "City of Santiago of the Cavaliers of Guatemala." But the earth had not yet righted itself, and the trembling kept up with slight interruptions till daybreak. The crowds either stood all night stupefied before their houses or moved down the middle of the streets towards the open squares to await in terror what might still be in store for them. When the dawn came the whole awful scene of destruction was laid bare.

The high massive façade of Saint Francis Church was rent in every direction, and great blocks of masonry lay scattered about. The roof of Saint Claire's Church had fallen in from altar to portal and burst open the heavy door. The tall fluted cupola of the Church of the Recollection, a marvel of grace and beauty, had fallen into the nave. The great yellow

glazed cupola of the Cathedral fell at the second shock with a terrific noise. Towers, belfries, and façades of churches in all parts of the city were either thrown down or split wide open, and left standing at all angles on the thick lower walls. The post office was smashed to pieces, and its wreckage filled the street. One entire wall of the railroad station had fallen out, and the clock tower was knocked down. The British Legation and the Custom-house were heaps of ruins. As for the dwelling houses, on all sides their outer walls were thrown down into the street, their roofs fallen in on gaping bedrooms and sitting rooms, their rafters and tiles piled on top of beds and tables, while smashed clocks, mirrors, and pictures littered the ground or hung awry upon the walls.

On December 26, when the violence of the tremblings had partly subsided, people began to creep back into their homes to rescue some of their belongings, principally bedding and clothing. It was then found that many houses which seemed uninjured from the outside were dangerously cracked within, and most of those left standing were so badly damaged that they would have to be torn down.

But we were to be spared that trouble; for slight shocks kept up during the whole of the 26th, and at two o'clock in the morning of the 27th a third powerful shock aroused the slumbering people, and many more houses were heard to fall. Also at intervals many walls that were out of plumb fell over of their own weight.

The Shock of December 28

On the 28th at half-past two in the afternoon a long and terrible shock overtook us. This was the first mighty and destructive shock that happened during daylight, and many women fainted with terror. It was on this occasion that Dr. Manuel Del Valle, riding out on a Red Cross errand, was caught by a falling house and crushed to death together with his horse.

Then followed a period of comparative respite, and people began to collect their senses. They soon got out their beds into the streets, set up their tables and bureaus around them, and covered the whole with carpets or any kind of cloth to shelter themselves during the night. They began putting up shacks of every nondescript shape in the parks and open squares. Probably there were not a dozen families that still dared to live in their shattered houses. In every public square and on the plains around the town sprang up villages of gypsy-like huts. They were crowded together; built of carts and carriages, pieces of furniture, and broken doors and windows; and covered with galvanized iron, helped out with blankets, flags, tablecloths, carpets, and sacking. While food at first was not exactly abundant, there was no famine or even actual want. The government saw to it that the people were well supplied with meat at low prices. Meat, maize cakes, and coffee were our principal diet in these days; and as soon

as the bakers could get to work again bread made its appearance, though it was bad and dear. New Year's Day came and went, and nobody thought of wishing his neighbor a Happy New Year except with a sarcastic laugh.

The Shock of January 3

During all these days the earthquakes never ceased. At intervals of an hour or so they reminded us that all was not yet well; but, as our lives now

Fig. 5—Ruined freight cars in front of customs house sheds. Of the original sheds only the walls are standing; the roof and sides were put up after the earthquake.

seemed safe and our property was already destroyed, we had become quite indifferent and hardly did more than look around us at each new tremor. But we were soon awakened from our indifference. On the night of January 3 came the terror of terrors, the most pitiless and awful blow that had yet struck this poor shattered city. At a quarter to eleven there was a loud subterranean growl, and the earth seemed to have been struck a great blow that sent it up, and then let it fall down with a thud, and then sent it swinging and shivering in swift jerks which kept on and on and would not stop, while the underground roarings continued till one's mind was so stunned and confused that it seemed as if the world were crumbling to pieces. This must have lasted a minute and a half.[2] No one now looked up to say unconcernedly "There's another" or to make flippant remarks. The helpless sufferers sat up on the ground where they had been sleeping, firmly propping themselves with their arms for support, and no words but "Oh, Oh, Oh" were anywhere heard. When the shock had passed away everyone felt like crying aloud at the cruelty and brutality of it all, but while it lasted one's only feeling was of groveling terror.

[2] According to a credible informant the shock lasted eleven minutes!

The Destruction Wrought

In the morning it was seen that the two massive towers of the Cathedral had been thrown down, one to the north on the Archbishop's residence, and the other to the south on top of the bishopric school. This seems to show that the oscillation was north and south. The beautiful Church of the Recollection was leveled to the ground, not a stone left upon stone. Even thick brick walls of the penitentiary were laid low; the fortress of

FIG. 6—The plaza in front of the Cathedral showing shacks, some of them housing government departments, erected after the earthquake.

San José, overlooking and dominating the city, could hardly be made out, for it was flat with the ground. The railroad station had been tumbled into one huge heap of wreckage. The entrance into the city for those who came by train will never fade from their minds. After leaving the train and the ruins of the station, one emerged upon a street buried with débris of fallen houses lying deep in dust, and up and down the street as far as eye could reach not a house was left standing. The center of the town suffered least. There, some ancient, low, and very solid brick houses were apparently uninjured; but probably not five out of a hundred houses in the city can be repaired and made habitable again.

Relief Measures

No official figures of the loss of life have been issued; but it is believed that less than fifty persons perished.[3] The first severe shock gave sufficient time to escape from the houses, and after that everyone camped out in the open; but some who ventured back into their houses to get out bedding and

[3] A later and what is believed to be more accurate estimate places the total number of dead as the result of the various shocks at six hundred.—M. H. S.

other effects were caught and killed in the second shock of Christmas night.

The distress has been much relieved by emigration to the country. Nearly all the planters and all others who have country places have sent away their families, and hundreds of these kindhearted people have sent out invitations indiscriminately to their city acquaintances to come out and join them in the country.

The six city banks and the United Fruit Company have built wooden offices in the main square. All bank credits have been suspended, and the banks have limited payments to each depositor to $25 a week. These measures have greatly increased the distress, for now no one has the wherewithal to pay his servants or employees.[4] The bank safes are supposed to be empty, for the banks have loaned out not only the paper bills they were authorized to issue, but almost all of their deposits. They have now asked the government for authority to issue the equivalent of two million dollars American gold in Guatemalan paper, so as to pay depositors and resume credits.

The Problem of Rebuilding the City

And now the problem that confronts us is the clearing away of the old town and the building of the new. This is such a large and many-sided question and has been thrust upon us so suddenly that no one is ready with a complete answer. In the first place where shall we get the means to rebuild? When San Francisco was burned down, she turned to the fire insurance companies for relief; but there is no insurance against earthquakes. At present our only hope is in the banks; but it is clear that they would have to loan almost the full value of the house in order to rebuild it, and would any bank be willing to do this?

Then again our whole system of building must be altered. It would be the height of folly to rebuild the city of brick and adobe in this land of earthquakes. On this all are agreed. With the introduction of frame buildings, which have shown themselves to be earthquake-proof, the streets should be widened, the houses built farther apart, a reformed and modern water system put in, and efficient fire protection established. Until we are prepared to do all this the reconstruction of the city should not be begun. Halfway measures would be unavailing and dangerous.

Fortunately for Guatemala the source of her wealth is not in the city. The city has never produced anything worth mentioning and has never been more than a trading place for the middleman and speculator and a lounging place for the idle and ignorant rich. The country's wealth lies in her ever-green pastures with their tens of thousands of head of cattle; her magnificent plantations of coffee and sugar; her fertile fields of grain; her orchards of tropical fruit; and her great forests of cedar, mahogany,

[4] This condition was modified later, and banks allowed depositors to withdraw any sums required.

and other precious timber. All this beautiful and bountiful inheritance is left to her still—and from it must come in the end the means to reconstruct a capital worthy of this wonderful land.

Here we sit beside our little shacks in the starlight with high hopes and great ambition, dreaming of our departed splendor and how to restore it. We intend to restore it, though it may take Guatemala City a generation of patient industry and economy to regain her past glory. Even then all about the newly risen town there will always stand the massive ruins of the great churches, like giants among pygmies, to remind our sons of the terrible Christmas night of 1917.

From here on the narrative is continued by Professor Saville.

The Shock of January 24

The sixth great shock came with the full moon on the evening of January 24. The writer was traveling from Quirigua to Guatemala by train, which had been delayed near Agua Caliente by a slight slide in one of the numerous cuts. Hence the train which should have arrived in the city at 6.30 P.M. was more than one hour behind time. At 7.25 precisely, when we were about five miles out and were just emerging from a deep cut, a stone about the size of a baseball came rolling down the side and struck the sill of the window by which I was seated. The next instant a deep roaring was heard, accompanied by a terrific jolt against the south side of the train. This was immediately followed by a lifting shock on the other side. The train was going slowly, perhaps four miles an hour, and the engineer brought it to a stop within twenty feet. My first impression, due to the stone which had fallen, was that the side of the cut had caved in and that enormous stones had been thrown under and against the train. When we found, however, that the train had not been struck, we at once understood what had happened. Soon we began to feel tremors and quiverings of the earth, and from this time until 4.30 A.M. the earth was never quiet. From time to time we experienced sharp shocks, and were afterward told that forty-three distinct earthquakes had taken place. The train proceeded about a mile farther, stopping three times to have small slides in the cuts cleaned out before going through. We came finally to the last and deepest cut about four miles outside the city. This we found to be choked up for some distance; it was not cleared for a week, as the walls had been so shaken that as fast as it was cleared it again filled up. We spent the night on the train, and walked into town the next morning. In many places the road was partially blocked by débris which had fallen along the sides, especially where the road descended into the *barranca* just before entering the city. In the four miles of road I counted two hundred cracks running approximately from south to north, although there were a

few running at right angles. This direction of the cracks may be significant, as they proceed from the general direction of the quiescent volcano Pacaya. That the movement comes from this region, and not from north to south, was clearly demonstrated by one crack which I observed in the middle of the road with four branches radiating towards the north for a short distance.

Many persons affirm that this shock or series of shocks was the worst shaking which the city experienced. Others award the palm to the shock of January 3. At this time all sorts of movements were noted. One of the railroad officials was at his desk and in reaching for the lamp noticed that his flat-bottomed inkstand had jumped into the air and turned completely over, coming to rest bottom side up. As the city had been almost entirely demolished by the previous quakes, no additional damage was done by this one. On the contrary the people were rather aided in their work by the falling of half-ruined walls and the general settling of partly ruined buildings.

Up to the time of my departure from the country, about February 20, slight shocks were of daily occurrence. As the first and sixth great shakes had come with the full of the moon, people were apprehensive about what would happen when the full moon again came round. Cable reports of February 26 state that telegraphic communication was interrupted at this time by earthquake shocks of an extremely violent character.

Present Conditions and Needs

Before this great calamity the city of Guatemala boasted a population of about 125,000. In February it was estimated that about 40,000 people had left the city. Some were slowly drifting back; but at that time people were still dazed, and the serious work of cleaning up had hardly begun. It is clearly evident that the inhabitants of this once beautiful city can never hope to rebuild it along the lines of the old city. Either concrete structures must be erected, which seems out of the question because of the great expense involved, or a city of wooden houses with corrugated iron roofs must spring up. This latter plan seems to be the most feasible one. With a single exception[5] every house not only in the city but for a radius of perhaps twenty miles was damaged. In the city itself perhaps twenty houses may be repaired. The débris of the rest must be removed and dumped into the *barrancas*, the great ravines which encircle the town. This in itself is something of a task, as it is estimated that more than two million cubic yards of stone and earth must be run out by portable railroads. Such a work cannot be accomplished in less time than eight or ten months. Meanwhile the people are living in shacks in the public parks and the plains outside of the city. The United States Government

[5] The exception noted is a house of reinforced concrete which was in process of construction and was absolutely undamaged.

after the first news of the disaster sent 4,000 tents, which have been put up in various parts of the suburbs, and the Red Cross is doing valiant work. The rainy season is at hand, and pestilence will surely break out with the coming of the long period of rains. The work of removing the débris will then be much retarded, as, instead of loose earth, mud will have to be transported. Altogether in this unfortunate place conditions exist akin to those in the devastated portions of France; but in Guatemala nature, not man, is responsible, and while there must soon be an end to man's destructive energy no one can foretell when the earth in this volcanic country will finally cease its shaking.

The Guatemalans look to us for assistance. The rebuilding of this city must be financed from the United States. Already the work of the Red Cross is fast drawing this people closer to us in the bonds of good fellowship, and we have now an opportunity to cement this union into a lasting friendship.

THE ZONES OF CIVILIZATION OF THE BALKAN PENINSULA

By JOVAN CVIJIĆ

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[With separate map, Pl. V, facing p. 480.]

No historical phenomenon in the Balkan Peninsula exhibits so complete an adaptation to geographical conditions as does the distribution of its ancient civilizations. After a period of advance or recession, caused by exceptional historical happenings, sometimes not connected with geographical conditions, the expansion of a civilization has generally been arrested by geographical barriers. Even the civilizations which have spread over nearly the whole peninsula have finally seen their zones of influence diminish in this way. An adjustment has taken place, a perfect adaptation to geographical conditions. Thus the different zones of civilization have developed in close connection with the principal geographical characteristics, particularly those which may be termed the characteristics of union and of penetration. To be sure one occasionally finds several civilizations superimposed one upon another like geological formations. More frequently one finds them dove-tailed, as it were. Nevertheless, one can distinguish regions where a particular civilization has left a deeper impress than others. Even the civilizations which have recently entered the peninsula already show this adjustment to the geographical aspects of union and of penetration and are almost limited to definite regions.

Effects of Early Civilizations—Greek, Roman, Celtic

Not every civilization which developed in or was imported into the peninsula has had the same effect on the Balkan population. The civilizations existing prior to the establishment of the Yugo-Slavs (South Slavs) and the Turks have had no influence on the bulk of the present population. Hellenic civilization was preserved neither by the Greeks nor by the remnants of the ancient populations of Illyria and Thrace, the Albanians and the Arumani of today. Roman civilization left numerous traces in a large part of the peninsula, particularly on the Adriatic coast. Here it furnished the basis on which a later civilization developed, namely the Mediterranean-Italian civilization. Latin strongly influenced the language of the Albanians and the Arumani, and Roman blood, it seems, mixed with that of the ancient Balkan population. The civilization of the Celts, who entered the peninsula from the north and spread almost as far as the Aegean region, has left no perceptible trace in the Balkan population.

The lack of continuity of the civilizational influences is a characteristic of the Balkan Peninsula, a condition the reverse of that which obtained in Western and Central Europe.

Byzantine and Venetian Influences

Even the civilizational influences of the period subsequent to the establishment of the Yugo-Slavs, namely, those of Byzantium, which affected all of the present Balkan peoples, were often strongly modified and in some regions even obliterated by the invasion of the Turks. Venetian civilization, modified to a certain extent by the earlier infusions of Roman and Byzantine civilization, and particularly by national spirit, has been preserved only on the Adriatic littoral. In addition, considerable Turkish and Oriental influences are to be met with in the Balkan Peninsula; likewise the influences of modern European civilization. Finally, a large part of the peninsula belongs to the Yugo-Slav patriarchal régime.

The area of distribution of these civilizations, particularly the Byzantine and Venetian, whose extension had almost become stable before the Turkish invasion, was considerably modified by the great migrations of the Balkan peoples in the Turkish period. This disturbance was due to the migrations of the Dinaric peoples to Dalmatia and of the Balkan peoples to the Yugo-Slav regions of Austria-Hungary. Not only the racial groups but also the civilization of the peninsula itself thus expanded toward the north, beyond the Save and the Danube as well as in Dalmatia.

Importance of the Distribution of Civilizations

The distribution of these various civilizations has in itself become a very important factor in the conditions of life and in the mental traits of the population. Not alone the extent of geographical influences on man and the relations of ethnic groups must be examined, but also the distribution of the different civilizations, as this is a factor which was in the past and remains in our day of great influence on all the ethnographical and anthropogeographical phenomena of the peninsula.

We shall indicate in this paper the distribution areas of the different civilizations. We shall characterize only those which concern the peninsula or have been modified by special Balkan circumstances.

Zone of the Old Balkan, or Modified Byzantine, Civilization

The evidences of Byzantine civilization to be observed today in the Balkan Peninsula only very rarely represent its best fruits. In the first place, the literary and intellectual side is missing, likewise the material acquisitions and the ease of life of the upper classes of Byzantine society. Only the remains of the civilization of the middle and lower classes are to be found, and even they only appear in a changed, almost

corrupted form. Although Byzantine civilization had already in the Middle Ages assimilated elements from Oriental civilization, it became still more deeply infused with these elements during the Turkish period. It was also subjected to Levantine influences. Thus modified, Byzantine civilization spread during the Byzantine and Turkish periods over the larger part of the peninsula, and even in regions which are today outside its confines. Byzantine civilization has thus become Balkan civilization *par excellence*, Balkanism in the true sense of the word.

Balkanism

Balkanism is thus not of the Orient, nor can it be identified with the Near East, as has often been done. This confusion is due to the impression created by Mohammedanism, by the Balkan Turks, by the relations which the southern regions maintained during the course of centuries with western Asia and northern Africa. Turco-Oriental influences have certainly left numerous traces in the peninsula. They have even modified Old Balkan civilization. But what is striking in the material civilization and the moral conceptions of Balkanism is notably the influence of ancient Byzantine civilization, which makes itself felt throughout the whole range of ideas, from the kitchen to the most subtle moral conceptions.

The Spread of Byzantine Civilization

The Greeks, the "Romans" of the Middle Ages, were and have remained the real representatives of Old Balkan civilization. Next in order come the Arumani, or Kutzo-Vlakhs, who were Byzantinized. The Turkish upper classes also adopted Byzantine civilization, although Mohammedanism, as a consequence of the rules of conduct of the Koran and the closed domestic life it prescribes, hindered its infiltration. The Balkan Yugo-Slavs began to adopt it during the course of their settlement in the provinces of the Byzantine Empire and particularly after their conversion to Christianity. Byzantine civilization continued to spread in the Serbian and Bulgarian states of the Middle Ages. Historians and archeologists have positively identified the influences, often preponderant, of this civilization in the architecture, the administration, the religious organization, as well as the law, the literature, and the material and intellectual life of the Serbian and Bulgarian states of the Middle Ages. However, the Bulgarian state was more completely exposed to these influences than the Serbian state, which adopted Western influences also and the development of which, besides, shows signs of its original evolution.

Influence of Turkish Rule and the Greek Church

During the period of Turkish rule the material civilization and the moral conceptions that emanated from Byzantium, or Stambul, in particular those of the Byzantine period of decadence, continued to spread throughout

almost the entire peninsula. The ancient frontiers which hindered the advance of Byzantine civilization had disappeared, and the means of transmission remained as effective if not more so. The Byzantine, or Greek, Church, as well as the Turkish state, flooded nearly the whole peninsula with a numerous clergy and communities which multiplied. The Greeks and the Grecized Arumani became the earliest traders of the peninsula, particularly in the central regions. They were the artisans known for their Old Balkan and Byzantine trades. They furnished the *handji*, the innkeepers, and the *bakals*, the grocers, in all the cities and even the villages along the main routes. With the Serbian emigrants they went beyond the Danube and the Save and spread throughout the cities and larger villages of Syrmia, the Banat, the Batchka, etc., where every *handji* and *bakal* called himself a "Greek" and still does to this day even when not Greek in nationality. Byzantine civilization was pre-eminently the civilization of the cities and of the main longitudinal routes Constantinople-Belgrade and Saloniki-Belgrade. The Turkish régime protected it. It is asserted that it has been disappearing rapidly with the progressive liberation of the various sections of the peninsula from Ottoman domination.

Present Distribution of Old Balkan Civilization

The present distribution of Old Balkan civilization is about as follows. Its influence is strongest south of the Balkan Range and the Shar Planina, particularly in Thrace, in Macedonia, and in Greece, less in Epirus and southern Albania. Although its northern limit is generally the Balkan Range and the Shar Planina, it has penetrated by the valley of the Morava to Nish and beyond to the Save and the Danube. We have seen above that it has even crossed these rivers and spread as far as Budapest and Vienna. But this offshoot north of Nish, forming a narrow band in the valley of the Morava and beyond, has almost completely disappeared in the last decades. Traces of Old Balkan civilization are better preserved on the coast of the Black Sea. Its survivals are more frequent in Bulgaria, even north of the Balkan Range, than in Serbia.

Byzantine civilization did not spread uninterruptedly throughout the southern parts of the peninsula. Here numerous "islands," or enclaves, of the patriarchal régime are to be met with in all the areas lying outside of the longitudinal depressions. The best conserved are in western Macedonia (in the Prespa, Morihovo, Poreteh, Kitchevo, Dibra, and Radika districts). Some also occur in eastern Macedonia (in the Ossogov massif, and the Malesh and Piyanetz districts). Another has been preserved in the basin of the Maritza (Sryedna Gora), south of the Balkan Range. Finally, there are traces left in west-central Greece, in the interior of the Peloponnesus, and on the island of Crete. However, the patriarchal régime differs noticeably here from that which exists in the Dinaric region, inasmuch as it has to a certain extent been influenced by Old Balkan civilization.

Rural Turkish Groups in Bulgaria, Thrace, and Macedonia

The large rural groups of Turkish population in eastern Bulgaria and in Thrace, on the left bank of the Vardar, and between Kailar and Ostrovo in Macedonia, have hardly been affected by Byzantine influences. The mixture of Balkan civilization and the patriarchal régime, of Mediterranean and Levantine influences along the Aegean coast, and of Turkish influences, makes of Macedonia a checkerboard, as it were. The limits of the different civilizations are all the more striking when they coincide with the limits of the nationalities. Nowhere does the contrast appear more clearly defined than in going from the basin of Kortcha into that of Prespa.[1]

The impress of Old Balkan civilization is still very noticeable in anthropogeographical phenomena and ethnographic characteristics. It is the opposite of the patriarchal régime in a material as well as a spiritual sense. Many stresses and internal quarrels have been caused by these differences; by them the historical antagonisms of the Balkan peoples have at times been sharpened.

The City Dwellers

Urban agglomerations are in general more numerous and larger in the zone of Byzantine civilization than in the northern regions of the peninsula. Their appearance, the type of their *karshiya*, their markets, even the style of the houses is different. Certain ancient trades are characteristic, namely those which have to do with the transportation of agricultural and animal products and merchandise by means of horse caravans, a medieval form of transportation which has been preserved to our day. Another characteristic industry is the making of women's garments, often encrusted with silver and gold like an icon. The city garments of the women often have Greek names and in form are in the main of Byzantine origin. The greater part of the widespread trade in filigree objects is of Byzantine origin. The cuisine is also original in character, in the matter of dishes and the methods of preparing and serving them. Even the names of the dishes are Greek or Aruman. Old Balkan civilization smacks of an easy and regulated life, and it is patent that this quality has been imparted to the Slav population by the Greeks and Arumani. All these Byzantine traditions and survivals are permeated with Oriental elements, and it is impossible today, without special investigation, to distinguish between those which were introduced before the Turkish invasion and those which were brought in later.

The spirit of the city dwellers and even of the rural population, the ideas as to the manner of gaining a livelihood, and the moral conceptions were formed and are still here and there dominated by the Grecized Arumani and the Greeks. The manner of life of the city dwellers and their

[1] J. Cvijić: The Anthropogeographic Problems of the Balkan Peninsula, Vol. 1 of "The Population of the Serbian Lands" constituting Vol. 4 of *Srpski Etnografski Zbornik*, Academy of Sciences, Belgrade, 1902; reference on p. xxvii. [In Serbian.]

savoir vivre are regulated by certain fixed standards, by certain maxims which often recall an ancient didactic literature. The guilds, or closed trade unions, the *esnai*, the associations within which all eventualities are regulated and foreseen, attest their ancient origin. All, Slavs as well as Arumani and Greeks, are distinguished by particular bigotry. The walls of their houses are covered with pious inscriptions, but that does not prevent them from exploiting their neighbors and even making money by unfair methods. The sense of duty, responsibility, and mutual consideration is generally poorly developed. The main motive is a desire for gain, and all means which lead to it are justified. From this an extreme individualism results which makes co-operative action almost impossible.

Church and State

As in Byzantium the empire rested less on nationality than on religion, so, in the zone of Byzantine civilization, the Greek-Orthodox faith was for a long time superior to nationality and the peoples had almost entirely lost national feeling. Besides, the Orthodox faith here has a very particular spirit. It is curious that not only the city dwellers but even the peasants have a liking for ecclesiastical quarrels—an inclination thoroughly Byzantine. Opposed camps who held different views on material and spiritual questions concerning the Church were always numerous and gave themselves up to vehement quarrels. The religious conflict between the Slavs and Greeks about the middle of the nineteenth century appears to have found a very favorable field in this inclination.

Turco-Oriental Influences

Turco-Oriental influences are numerous and widespread. As a result of the Eurasian characteristics of the southeastern part of the Balkan Peninsula, they penetrated there before the Turkish invasion, particularly through the intermediary of Byzantium. Are not the Greeks installed on the Cyclades and on the coasts of Asia Minor a people belonging to Western Asia almost as much as to the Balkan Peninsula? A seafaring people, have they not throughout the centuries remained in close relations with Asia and Northern Africa? Numerous products and material objects have been borrowed from these regions and spread throughout the Balkan Peninsula since remotest times, mainly the various kinds of wheat, fruit trees, flowers, etc. Byzantine civilization was itself permeated with Oriental elements, which were in turn transmitted to all the Balkan peoples. Oriental influences are quite evident in the Serbian, Bulgarian, and Greek literatures of the Middle Ages and in Serbian art of the same period. Very old Oriental motifs are to be met with in the folklore and especially the folk songs and ornaments of the Balkan peoples.

Effects of Turkish Rule

But the Turco-Oriental influences spread in the peninsula mainly during the Turkish period. They are naturally strongest among the Turkish populations, which settled in the southeastern and central parts of the peninsula, and among the Moslemized inhabitants and the Albanians, who are in the main a Mohammedan people. There are numerous Moslemized Serbians, particularly in Bosnia and Herzegovina, likewise Moslemized Bulgarians (Pomaks) in the Rhodope Mountains. These Moslemized inhabitants have contributed in large measure to the spread of Turco-Oriental influences, not only by adopting them themselves but also by spreading them among the Christian populations of their own language. Turco-Oriental influences have, indeed, in the course of the long Turkish domination, become rooted among all the Balkan peoples and, as a consequence of the metanastasic[2] migrations, also in the Yugo-Slav regions of Austria-Hungary, even in those that were not subjected to Turkish domination. They can be traced in the style of harness and weapons as well as in the type of cities and houses; in the prevalent indolence and laziness, the Oriental *yavashluk*, as well as in the squatting posture in which many tasks are performed; furthermore, in the Oriental prejudices, in the kindness and honesty of the Turk as well as in his fits of brutality, a trait characteristic of certain peoples of Western Asia.

"Raya" and "Bulgarian"

The century-long domination of the Turks has had another effect. It has impressed upon the Balkan peoples more or less the traits of the *raya*, the characteristics of an oppressed class.

Like Byzantine civilization, Turco-Oriental influences predominate in the southeastern part of the peninsula, that is in the region with Eurasian characteristics. They have also taken deep root along the longitudinal routes of the Maritza-Morava and the Vardar-Morava valleys as far as Nish, that is to say precisely in the region where the Yugo-Slav population shows the *raya* characteristics most clearly. This fact, as pointed out in the writer's previous article in the May *Review*, has been the cause of an important ethnographical error concerning the meaning of the term "Bulgarian." This term became synonymous with *raya* and was applied to the whole oppressed population, even to the Serbian population of the southern regions. To the north of Nish and in the Dinaric regions Turco-Oriental influences are less evident, excepting in the Moslemized districts of Bosnia. They are insignificant among the ancient Yugo-Slav population of Austria-Hungary, but much more noticeable among the Dinaric immigrants in these regions. The Slav populations which are least affected by these Turco-Oriental influences are the Slovenes and the Croats of "Civil Croatia" (districts of Zagreb, Varazhdin, and Krizhevatz).

[2] For an explanation of this term see footnote 2 in the author's previous article in the May *Review*, p. 346.—Edit. Note.

Zone of Western Civilization

Of great interest are the various contacts between the West and the Balkan world. We have already referred to the traces of Roman civilization in the peninsula. The Balkan world has also been in contact with the West at the time of the Crusades, at the time of the rule of the House of Anjou in Albania and of the Franks and the Latins on the Aegean coast and at Constantinople. More important was the influence of the city republics of Italy, particularly Venice and Genoa, which made itself felt along the whole Balkan littoral from the Adriatic to the Black Sea. Finally, we will call attention to the significance of new Western influences which operated during the course of the nineteenth century. All these influences can be grouped under the name of Mediterranean and Western civilizations in contrast with the civilization of Central Europe, of which the influences, although recent, are becoming more and more important.

Limits of Western Influences

The routes of penetration and the geographical distribution of these two groups of civilizations are different. The Western civilizations reached the Balkan Peninsula chiefly by means of the sea routes and penetrated into the interior by the transverse routes which start from the Adriatic. Although Roman civilization, and even Venetian civilization to a certain extent, spread over a large part of the peninsula, their advance has finally been halted by the topography of the region, and they are at present limited to the narrow coastal strip, mainly on the Adriatic. It is the rugged relief of the country which has stopped the spread of these influences, just as it has prevented the spread of the Mediterranean climate toward the interior. As soon as one leaves the towns of the Adriatic coast, the Western influences disappear and the patriarchal régime becomes predominant.

Extent of Mediterranean Influences

The Mediterranean influences are more or less noticeable throughout the whole Balkan littoral from Trieste to Constantinople. They belong essentially to the same civilization that is met with on all of the European coasts of the Mediterranean, modified to a certain extent by the different nationalities that occupy the coasts of the Balkan Peninsula. It has rather a Levantine and Greek aspect at Constantinople (particularly among the inhabitants of the suburb of Pera) and on the coasts of the Sea of Marmara and the Aegean. On the Albanian coast there is a mixture of South Italian, Greek, Turco-Oriental, and even patriarchal influences. On the Adriatic coast the urban agglomerations, the house types, and the manner of living bear a Mediterranean aspect, superimposed on a Serbo-Croat foundation. The ancient sway of Venice has dotted the landscape with ruins of small forts and other structures bearing the Venetian coat-of-arms and has impressed the republican spirit on the mentality of the city dwellers.

Italian Traces in the Interior

The interior of the Balkan Peninsula even today is not entirely free from Western influences. Roman civilization has left its traces on the native population, the Illyrian and Thracian tribes who, in the area north of a line extending from Alessio to Ratiaria, became half Romanized. This ancient population was assimilated by the Serbo-Croats but left its traces on them. An important Serbian group in the Dinaric Mountains, the Era clan, has mental traits very similar to those of the Latin peoples of Western Europe. Words of Latin origin have been introduced into the Serbo-Croatian language, probably by the old, half-Romanized Balkan population. A part of this population which fled before the Slav invasion into the central and eastern parts of the peninsula, has, according to certain linguists, greatly influenced the Serbian and Bulgarian dialects of those districts.

The relations of the republic of Venice with the Serbian kingdom of Rashka in the Middle Ages have also left traces in the interior of the peninsula. The Western influences in the architecture of Serbian churches of the twelfth to fifteenth centuries are well known. Numerous weapons and cloths of Venetian origin are mentioned in Serbian folklore, particularly in the folk songs. In the Serbian language there are words of Italian origin which probably date from this period (*piana, pogatcha, bisage,* etc.). The Dinaric regions and even the parts of Serbia along the Morava maintained commercial relations with Italy by the route of Ragusa as late as the end of the eighteenth century (export of cattle). The fine flour of Yakin (Ancona) and the flour pastes of Italian origin were still known in the Metohiya, the region of Pe͡ıy, or Ipek, in the first decades of the nineteenth century. They were known even in eastern Bulgaria, probably introduced by Genoese merchants. At Karlovo, in the sub-Balkan depression, several ancient houses and shops of the Italian type were seen by the writer.

Catholicism

There remains to be discussed the most important of the Western influences in the peninsula, Catholicism and the Latin alphabet which accompanied it. But a distinction must be made. It is only on the Adriatic coast that Catholicism was in constant connection with Western civilization. In Bosnia and other Yugo-Slav countries outside of the peninsula Catholicism has been allied rather with the civilization of Central Europe. In Bosnia particularly it was spread and supported from Hungary.

Central European Influences

The influences of Central Europe in the Balkan Peninsula hardly made themselves felt until the end of the eighteenth century. The temporary occupations of certain regions by Hungary in the Middle Ages did not leave any traces. After the Austro-Turkish wars and after the great

Serbian migrations of the Turkish period, the commerce of the northern part of the peninsula was directed towards Austria. The relations with this country became more and more numerous and varied and continue to do so to this day. German influence also begins to enter in the last decades.

The Magyars, people of the great Hungarian lowland, the Alföld, had hardly anything to do with the spread of Central European civilization in the peninsula. Hardly any Balkan inhabitant speaks Hungarian. The immense Hungarian plain is considered by the Balkan inhabitant a space to be crossed as quickly as possible without stopping. Hungary itself, in order to obstruct a closer contact between Serbia and the Yugo-Slavs of the kingdom, limited all relations with the Balkan Peninsula, even on the two railroad lines Belgrade-Fiume and Belgrade-Vienna. As a consequence a basin which is predestined by nature to serve as a link between peoples and to facilitate the propagation of civilization has played the rôle almost of an obstacle, hindering contact and the interchange of influences.

Nevertheless the civilization of Central Europe has penetrated along the valleys and longitudinal routes into Serbia and Bosnia and even into Bulgaria, although further removed, and has finally spread to Saloniki and Constantinople. It has reached numerous cities and even the villages of the valleys that are followed by the railroads and the more important roads. Its traces are superimposed on the traces of Byzantine civilization and the patriarchal régime. It finds expression mainly in the material side of life and increasingly in the tastes of the urban population. But the civilization of Central Europe has been able only in a limited way to influence the mentality and the spirit of the Balkan peoples, particularly those of the independent Balkan states. In Serbia the spirit of society is totally different. Numerous men have been trained in Western Europe, particularly in France, and the rest have also adopted Western ideas. The institutions, although based on national tradition and spirit, are more related to those of Western than to those of Central Europe. There is in the independent Balkan states and especially in Serbia a marked tendency to create, out of the various civilizational influences and by drawing on native resources, an original national civilization.

The case is not entirely the same in Bosnia and particularly in Croatia and Slavonia, where, in the large cities, foreign rule considerably impedes the maintenance of national tradition.

The Patriarchal Régime

The regions of the peninsula lying north of the Shar Planina and the Balkan Range belong in general to the patriarchal régime, excepting for the narrow Adriatic littoral and the northern plains of Serbia. South of this boundary large enclaves of the patriarchal régime exist in the moun-

tainous ramparts of the Sryedna Gora, the Rhodope Mountains, and the Pindus as well as in a large part of Albania. Other enclaves are those which have been discussed above.

We should not consider the patriarchal régime of the peninsula a régime without civilization. On the contrary, the population whose mode of life it is, is distinguished by moral conceptions of a high order and by other evidences of civilization. Its particular philosophy of life, its social and economic organization, and its well-developed institutions, its art and poetry are all of indisputable merit.

The Yugo-Slavs

The patriarchal foundation among the Yugo-Slavs dates from their settlement in the Balkan Peninsula at the beginning of the Middle Ages. Their organization in clans and *zadrugas* (i. e. communal associations of several families under one roof) weakened or disappeared under the influence of Byzantine administration and civilization as well as under the administrative system of the Yugo-Slav states of the Middle Ages. At the time of the Turkish dominion the Yugo-Slavs inhabiting the regions outside the zone of ancient civilizations reverted to the patriarchal régime. A certain ethnographic rejuvenation then took place: ancient social organizations and customs which had almost disappeared, revived and developed anew. But in spirit and content this patriarchal régime is different from the earlier one. The broad historical experiences of the Yugo-Slavs during the Middle Ages have left in their consciousness more or less profound traces. Left to themselves, the most vigorous of these patriarchal populations have drawn from these experiences definite opinions and moral sentiments which pervade their folklore and are evident in their actions. This development has been able to take place more easily and more completely among them than among the Yugo-Slav populations which remained subjected to Austrian and German influences.

Clan and "Zadruga"

The general characteristics of the patriarchal civilization as thus described are not the same in the various regions where the patriarchal régime obtains. The most notable differences are to be found in the social organization. The clan (*pleme*, pl. *plemena*, in Yugo-Slav; *fise* in Albanian) is to be met with only in Montenegro, in the regions adjacent to the ancient kingdom of Rashka, and in northern Albania among the Serbs and Albanians. The *zadruga* exists throughout the western and central portions of the peninsula from the Adriatic to the Isker River in Bulgaria, as well among the Serbs as among the Albanians. It disappears to the south as soon as one approaches the Greek population of the Aegean littoral. It is not to be found among the Bulgarians. It is lacking among the Turks.

The *zadruga* is still existent in all the Yugo-Slav districts of Austria-Hungary, particularly in Dalmatia, Croatia, Syrmia, the Batchka, and the

AUSTRIA
HUNGARY
ADRIATIC SEA
ITALY
VENICE
[VENEZIA]
TRIESTE
[TRST]
Villach (Beljak)
Klagenfurt (Velovetz)
Udine
Gorizia (Gorica)
Lyubliana (Laibach)
Cilli (Celje)
Marburg (Maribor)
Varazdin
Zagreb (Agram)
Gottschee
Karlovatz (Karlstadt)
Fiume (Rijeka)
ISTRIA
Pola (Puly)
TZRES (CHERSO)
VEGLIA
PAG (PAGO)
Gospitz
Zadar (Zara)
Bihaty
Kljutch
Bangaluka
Tuzla
Yaytze
Travnik
Livno
Zhupanyatz
Sarayevo
Uzhitze
Mostar
HERZEGOVINA
BRATCH (BRAZZA)
VIS (LISSA)
KHVAR (LISSINA)
KORTCHULA (CURZOLA)
MLYNY (MELEDA)
Dubrovnik (Ragusa)
Metkovitz
Nikshitch
MONTENEGRO
Kotor (Cattaro)
Tzetinye (Cettigne)
Bar (Antivari)
Ulcinj (Dulcigno)
Lyesh (Alessio)
Durres (Durazzo)
Tirana
Vlore (Valona)
Petch
Baya
Szeged
Szabadka (Subotica)
Mohatch
BARANYA
Zombor
Senta
Kula
Essek (Osyek)
Pozhega
Palanka
Novi Sad (Neusatz)
Veliki Kikinda
BATCHKA
BANAT
Temesvar
Vershets (Vrshatz)
Bela Tzrkva
BELGRADE
(BEDGRAD)
Pozharevatz
Kragujevatz
Uzhitze
Syenitza
Novibazar
Mitrovitze
Prishtina
Prizren
Ipek
Dibra
Okhrida
Berat
Elbasan
Kortcha (Koritza)
Kastoria
Drin R.
Vardar R.
Maros R.
Theiss R.
Danube R.
Save R.
Drave R.
Piave R.
Tagliamento R.
Lake Balaton
Bekesh Tchaba
Arad
Temesvar
Pancsova
Semlin
Mitrovitze
Novibazar
Prishtina
Prizren
Ipek
Dibra
Okhrida
Berat
Elbasan
Kortcha
Kastoria
Vlore
Durres
Tirana
Lyesh
Ulcinj
Bar
Kotor
Tzetinye
Nikshitch
Dubrovnik
Metkovitz
Mostar
Sarayevo
Uzhitze
Livno
Zhupanyatz
Travnik
Yaytze
Tuzla
Bangaluka
Kljutch
Bihaty
Gospitz
Zadar
PAG
VEGLIA
TZRES
Pola
Fiume
Gottschee
Karlovatz
Zagreb
Varazdin
Marburg
Cilli
Lyubliana
Gorizia
Udine
Villach
Klagenfurt
Tagliamento R.
Piave R.
Isonzo R.
Save R.
Drave R.
Danube R.
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Bekesh Tchaba
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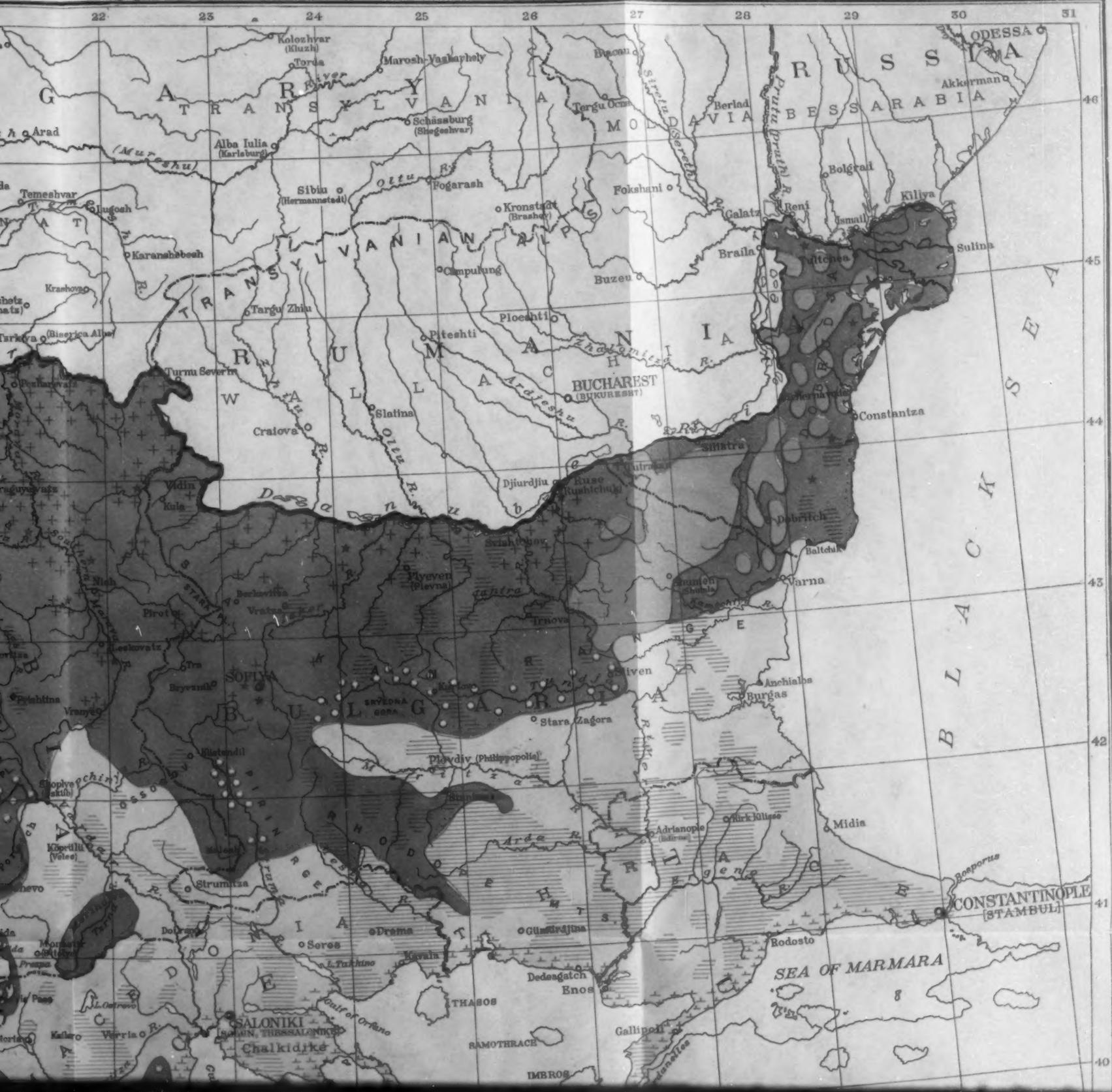
Pozharevatz
Kragujevatz
Uzhitze
Syenitza
Novibazar
Mitrovitze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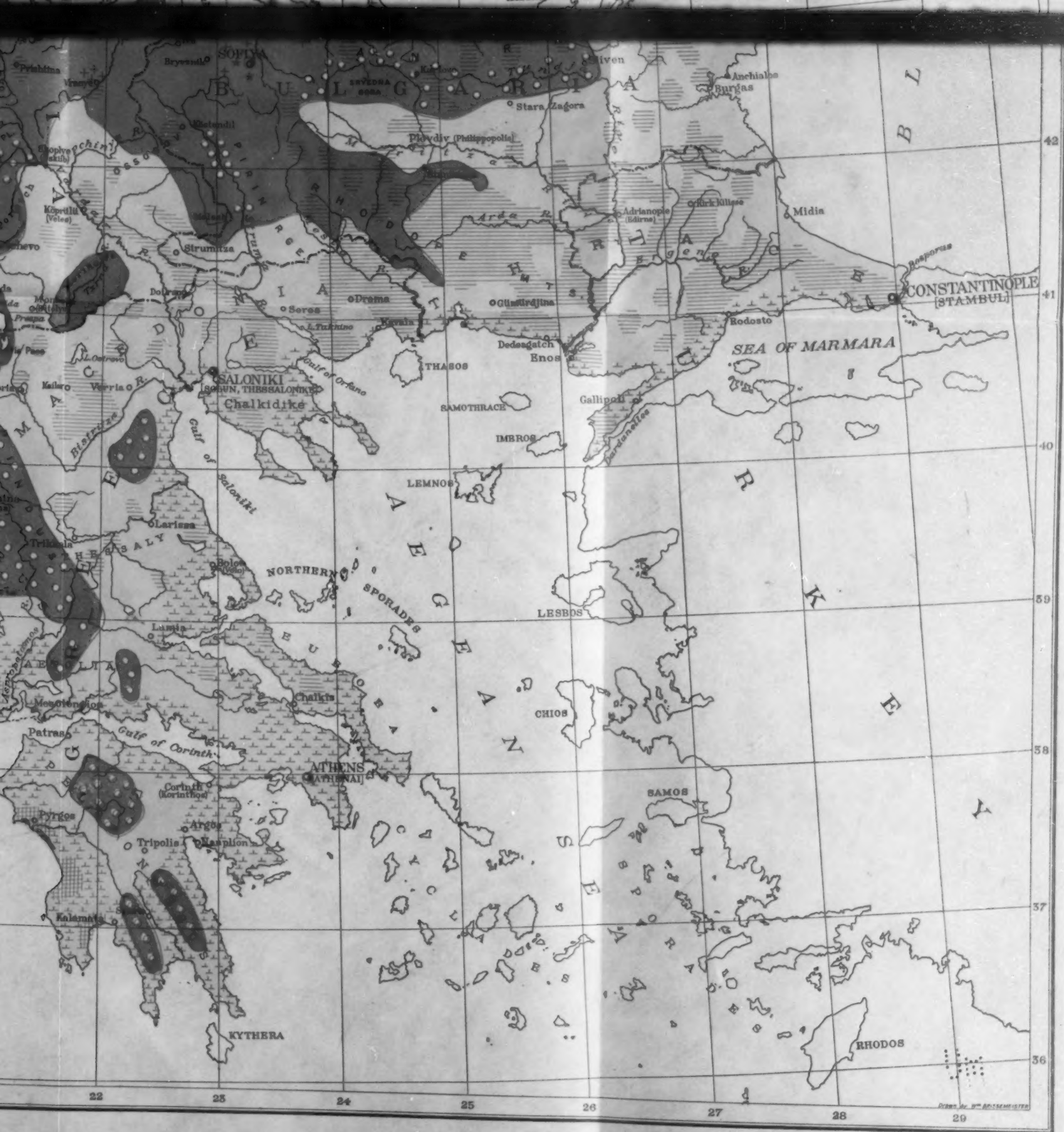
RUSSIA
ODESSA
Akkerman
BESSARABIA
MOLDAVIA
Berlad
Bacau
Targu Ocna
Siretu (Seret) R.
Prutu (Pruth) R.
Bolgrad
Kiliya
Reni
Ismail
Galatz
Fokshani
Braila
Sulina
Buzeu
Ploeshti
Kronstadt (Brashov)
Pogarash
Sibiu (Hermannstadt)
Oltu R.
Schässburg (Shegeshvar)
Alba Iulia (Karlsburg)
Arad
Temeshvar
Lugosh
Karanshebesh
Krashovo
Targu Zhiu
Campulung
TRANSYLVANIAN ALPS
TRANSYLVANIA
Piteshti
Slatina
Craiova
Turnu Severin
RUMANIA
WALLACHIA
Ardjeshu R.
Dambovitza R.
BUCHAREST (BUKURESHT)
Constantza
Tultchea
Silistra
Djiurdjiu
Ruse (Rushtchuk)
Dobritch
Baltchik
Varna
Shumla (Shumen)
Slivno
Anchialos
Burgas
Stara Zagora
Plevna (Plevna)
Lovatz
Pirot
Vrashka Chuka
Berkovitza
Vratza
Vidin
Kula
Danube R.
Timok R.
Iskar R.
Isker R.
Yantra R.
Rusenski Lom R.
Tundja R.
Maritza R.
Arda R.
Rhodope Mts.
Rila Mts.
Pirin Mts.
Perim
Pyshtina
Vranya
Kustendil
Strumnitza
Drama
Seres
Kavala
Dedeagatch
Enos
THASOS
SALONIKI (SALON., THESSALONIKE)
Chalkidike
Gulf of Orfano
Gallipoli
RAMOTHRACH
IMBROS
Dardanelles
SEA OF MARMARA
Rodosto
Midia
Kirk Killisse
Adrianople (Edirne)
CONSTANTINOPLE (STAMBUL)
Bosporus
BLACK SEA

ZONES OF CIVILIZATION
OF THE
BALKAN PENINSULA
BY
JOVAN CVIJIĆ
Scale 1 : 5 000 000
0 50 100 miles
Patriarchal régime
Old Balkan (modified Byzantine) civilisation
Turco-Oriental influences
Italo-Mediterranean influences
Mediterranean influences
Central European influences
Western European influences
National civilisation based on the civilisations of Central and Western Europe
The names are rendered as far as possible in the language of the predominant race of a given region. All names (except Italian and German) have been transliterated, whether they belong to languages using Latin characters (e.g. Magyar, Rumanian, Croatian) or not. The transliteration is according to sound, except for modern Greek, where it is according to letter. The system followed is that of the Royal Geographical Society ("Hints to Travellers," 9th. edit., London, 1906, Vol. 2), except for these changes and additions: tch for ch; dj for j; ts for ts; ö like German ö or French eu; ü like German ü or French u.
Political boundaries as in July, 1914.
MONTENEGRO
ALBANIA
GREECE
CORFU
LEUKAS
KEPHALLENIA
ZAKYNTHOS
IONIAN SEA
ADRIATIC SEA
Dubrovnik (Ragusa)
Kotor (Cattaro)
Bar (Antivari)
Ulcinj (Dulcigno)
Lyesh (Alessio)
Durés (Durazzo)
Tirana
Elbasan
Berat
Vlore (Valona)
Argyrokastron
Prizren
Prishtina
Peja
Ipek
Prizrend
Okhrida
Monastir
Kastoria
Janina
Prevesa
Arta
Missolonghi
Patras
Tirhala
Volo
Salonika
Kavalla
Drama
Seres
Monastir
Uskub
Kumanovo
Veles
Kotchana
Kratovo
Kochani
Strumitza
Petch
Kustendil
Sofia
Philippopoli
Adrianople
Rodosto
Gallipoli
Dedeagatch
Xanthi
Gumurjina
Kavalla
Salonika
Volo
Larissa
Trikkala
Arta
Prevesa
Janina
Kastoria
Florina
Monastir
Ochrida
Berat
Elbasan
Tirana
Durés
Vlore
Argyrokastron
Corfu
Leukas
Kephallenia
Zakynthos
Patras
Missolonghi
Arta
Trikkala
Larissa
Volo
Salonika
Kavalla
Drama
Seres
Xanthi
Gumurjina
Dedeagatch
Rodosto
Gallipoli
Adrianople
Philippopoli
Sofia
Kustendil
Petch
Strumitza
Kochani
Kratovo
Kotchana
Veles
Uskub
Kumanovo
Monastir
Ochrida
Kastoria
Florina
Janina
Prevesa
Arta
Missolonghi
Patras
Tirhala


SOFIYA
Prishtina
Bryvenik
Kyustendil
Shqiperise (Skhipetar)
Kicevo
Strumitza
Doiran
Seres
Drama
Gumurdjina
Kavala
L. Tachino
Dedeagatch
Enos
Rodosto
CONSTANTINOPLE [STAMBUL]
Bosporus
SEA OF MARMARA
Midia
Kirk Kilisse
Adrianople (Edirne)
Stara Zagora
Plevdiv (Philippopolis)
Sliven
Anchialos
Burgas
THASOS
SALONIKI [SOLUN, THESSALONIKE]
Chalkidike
Gulf of Orfano
Gulf of Saloniki
Kailaro
Verria
Bistritze R.
SAMOTHRACE
Gallipoli
Dardanelles
IMBROS
LEMNOS
Larissa
Trikkala
THESSALY
NORTHERN SPORADES
LESBOS
Lamia
Mesolongion
Chalkis
EUBOEA
CHIOS
Patras
Gulf of Corinth
ATHENS [ATHINAI]
Corinth (Korinthos)
SAMOS
Pyrgos
Argos
Tripolis
Nauplion
Kalamata
KYTHERA
RHODOS
AEGEAN SEA
BLACK SEA
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Banat. This institution was strongly reinforced by the Dinaric immigrants during the course of the Turkish domination.

Closely related to the social organization in clans and *zadrugas* are the phenomena of material life as well as numerous special mental traits. Almost all of the population belonging to the patriarchal régime has, more or less, been affected by Turco-Oriental influences.

Influence of Rome vs. that of Constantinople

Historians often maintain that a profound separation has taken place in the Balkan Peninsula between the zone of influence of Rome and that of Constantinople, particularly after the division of the Roman Empire into the western and the eastern empire under Theodosius in 395 A. D. The northwestern part of the peninsula, favored by its position and by its geographical characteristics, which facilitated penetration from the west, joined itself more closely to Western civilization, they say, while the greater part of the peninsula accepted Eastern civilization—the civilization of Byzantium. The results of these different influences, it is asserted, are still evident in our day. The most striking aspects of these differences are the Catholicism and the use of the Latin alphabet of a section of the Yugo-Slavs, as compared with the Greek-Orthodox faith and the use of Cyrillic characters by the majority of this race.

The Patriarchal Régime vs. Byzantine Civilization

The present distribution of the different civilizations of the peninsula corresponds to a certain extent to this widely accepted belief. As a consequence of the migrations in the Turkish period and of the ethnographic rejuvenation of which we have spoken, the civilizational influences, both of the West and of Byzantium, have become effected in the regions north of the Shar Planina. The most pronounced boundary in this region is not the boundary between Byzantine and Western civilization, but that between the patriarchal régime and Byzantine civilization. Thus Balkanism, that is to say, Oriental influences and the influences of the ancient Byzantine civilization, becomes more and more marked as one advances from the Dalmatian Adriatic toward the Black Sea and toward Saloniki and Thrace. It is in the same direction that Balkan mentality and the passions which move the Balkan world become more and more marked.

Catholic Enclaves

Mention should also be made of the islands of Catholic population to the west of the Bosna River in the midst of Greek-Orthodox and Moslemized Serb populations. But these Catholic islands themselves belong to the patriarchal régime. Besides, in so far as it is Catholic, this population is more related to Central Europe than to Western Europe.

The ethnic foundation of the patriarchal populations is the same among the Catholic Yugo-Slavs and the Greek-Orthodox Serbs. They are mixed north of the Save River as well as to the west of Bosnia. The migrations which took place in the Turkish period have brought numerous Greek-Orthodox Serbs into Croatia and Slavonia, where today they form a third of the Slav population. The Catholics themselves are descended in part from the Greek-Orthodox populations which were converted during the last centuries.

Region of Unbroken Western Influence

The only region where Western influences exist practically without interruption is the Adriatic littoral, chiefly Dalmatia. But even on this coast Byzantine civilization had, after Roman civilization, taken deep root. Furthermore, Byzantine civilization was the basis of the Venetian civilization which penetrated the coastal region. Finally, a large Serbian population belonging to the patriarchal régime migrated to Dalmatia during the Turkish dominion and settled even in the cities. The awakening of Serbo-Croatian nationalism and the development of a native civilization have obliterated almost all, except the material, traces of Venetian civilization.

THE SUN AND THE WEATHER: NEW LIGHT ON THEIR RELATION

By ELLSWORTH HUNTINGTON

The psychology of great advances in science is most fascinating. As long ago as 1651, as we learn from Professor Helland-Hansen and Dr. Nansen in a recent elaborate monograph,[1] Father Riccioli, a Jesuit priest, announced that when sunspots are numerous the temperature of the earth's surface falls, whereas when spots are few the temperature rises. In 1801 the great astronomer Herschel confirmed this conclusion. Then in 1826 the Bavarian astronomer Gruithuisen showed that when sunspots are numerous the storminess of the earth increases. Thus a century ago the two main facts as to the relation between solar changes and terrestrial weather were already known.

The Greatest Meteorological Problem of the Day

The Anomaly

For a hundred years, however, there has raged a great controversy over this question—a controversy of ever increasing intensity. At last the work of many students, and especially the final tabulations of Köppen, published in 1914, have placed one phase of the matter beyond the possibility of question: the temperature of the earth as a whole falls when sunspots increase and rises when they decrease. At the same time the measurements of the sun's radiation made by Abbot and others are rendering it more and more clear that the sun emits more heat when sunspots are numerous than when they are few. Thus the anomaly of a warmer sun and a cooler earth appears now to be well established. Nevertheless, so far as the writer is aware, no weather bureau in any of the great countries of the world has officially admitted the truth of this relationship.

Relation between Solar and Terrestrial Atmospheres

The controversy over the reality of a connection between the activities of the sun's atmosphere and that of the earth being almost ended, a new question has arisen. What is the nature of this connection? The conservative school holds that the connection must be purely thermal. An unusual supply of heat from the sun must warm the surface of land and sea. The warming of the sea must be of especial importance. This is

[1] Björn Helland-Hansen and Fridtjof Nansen: Temperaturschwankungen des Nordatlantischen Ozeans und in der Atmosphäre: Einleitende Studien über die Ursachen der klimatologischen Schwankungen, *Kristiania Videnskapselskapets Skrifter: Mat.-Naturv. Klasse, 1916*, Art. 9 (pp. 1-341), Christiania, 1917. The present paper is based on this important work on the relation between solar and terrestrial changes. See also Nansen's abstract in *Journ. Washington (D. C.) Acad. of Sci.*, Vol. 8, 1918, pp. 135-138.

partly because evaporation, cloudiness, and rainfall must thereby be increased, and partly because the heat received by the water, especially in equatorial regions, is transferred to other regions by means of ocean currents. As to the anomaly of a warm sun and a cool earth the supporters of this school offer various explanations. Some hold that increased evaporation causes increased cloudiness and thus shuts out the sun's heat, thereby lowering the surface temperature. This seems much like reasoning in a circle. Hence others believe that the oceanic circulation is so altered that more cold water wells up from beneath and thus the temperature of the surface is lowered. Still others, following Humphreys, believe that at sunspot minima, when the sun emits less than the usual amount of heat, the proportion of ultra-violet rays in the sunlight increases. This is supposed to be due to the relative clearness of the sun's atmosphere, which at such times is comparatively free from prominences or protuberances formed by clouds of gases at high altitudes. The ultra-violet light is supposed to increase the formation of ozone in the upper layers of the atmosphere. Ozone permits waves of short length, such as those of light, to pass through it easily. It hinders the waves of greater length, that is the heat waves which radiate from the earth into space. Thus the ozone is thought to act as a blanket and keep the earth warm at times of few sunspots, while at times of many spots the heat waves are allowed to escape.

Theory of the Radical School

The radical school rejects the idea that changes in the temperature of the earth's surface are the primary cause of the climatic variations which seem to be associated with changes in solar activity. They believe that the primary cause is found in the atmospheric circulation. The group of students who hold this belief in one form or another includes the two Lockyers, Bigelow, Veeder, Kullmer, and others; it is now re-enforced by the Norwegian authorities, Professor Helland-Hansen and Dr. Nansen, the Arctic explorer. The members of this radical group hold that when the sun is active it somehow causes changes in the upper atmosphere. Thus the distribution of atmospheric pressure is disturbed, the strength of the winds is increased, and especially the location, area, and relative intensity of centers of high and low pressure are altered. This causes such changes in the strength and direction of the winds that corresponding changes in temperature occur, and the effect of increased solar heat may actually be reversed. Veeder, basing his opinion upon a study of centers of high pressure, believed that when the sun is active great masses of the upper air are transferred bodily to those centers. This air is supposed to descend and cool the lower atmosphere, while at the same time its movements disturb the atmospheric equilibrium and thus give rise to more abundant and stronger storms. The writer, basing his opinion upon a study of centers of low pressure, has come to a similar conclusion. He believes that at times

of solar activity the well-attested increase in the cyclonic activity of ordinary storms, thunder storms, tropical hurricanes, and the like carries great masses of relatively warm air to high levels. There it grows cool. Thus it radiates into space the extra heat received from the sun at such times. It even carries this radiation to such a point that the earth's surface is actually cooler at times of abundant solar radiation than at times when less heat is received and when the earth's atmosphere is less active. This belief, it will be seen, is essentially the same as Veeder's, the two being opposite sides of the same shield.

The radical group of meteorological students are often regarded by their colleagues as visionary. There is some ground for this opinion. The conservative group appeals to a motive force, or type of energy, whose efficacy is undoubted. The effect of heat can be seen by everyone every day in the year. Therefore the group of students who assert that thermal conditions are sufficient to explain all meteorological phenomena feel that they are on safe ground. The radical group is obliged to confess that in this respect it is at a distinct disadvantage. It is forced to appeal to some other motive energy whose mode of action is not so clear as that of heat. The sun emits light, heat, and the types of energy known as electrical, magnetic, and radioactive. Among these, aside from heat, the electro-magnetic group is the most probable source of disturbances in the earth's atmosphere. Therefore the radical meteorologists generally believe that electro-magnetic energy must have something to do with the relation between the solar and terrestrial atmospheres. Nevertheless they do not yet know quite how their supposed force can produce the observed effects. They feel, however, that this difficulty is less than the difficulty of holding to a purely thermal hypothesis in the face not only of the great anomaly of a warm sun and a cool earth, but of many minor anomalies.

Radical and Conservative Positions

One important point needs emphasis. The conservative school does not regard temperature as the solution of the whole question, nor does the radical school regard atmospheric circulation as the whole solution. The conservative meteorologists merely say that the chain of events *begins with temperature*. An unusual degree of heat on any part of the earth's surface causes changes in atmospheric pressure and also in the temperature gradients between different parts of the ocean. This leads to winds, ocean currents, storms, and precipitation. These in turn lead to further changes of temperature. Thus new conditions of atmospheric pressure and of oceanic gradients are established, and the wheel comes round full circle.

The radical meteorologists believe in exactly the same circle of events. They do not question the importance of changes of temperature. No sane man who knows how the seasons cause the most extreme changes in every kind of climatic conditions can possibly do so. They admit freely that

variations in solar radiation due to the differing angle of the noonday sun are the most important of all climatic phenomena. They also admit with equal readiness that any change in the amount of heat received from the sun is bound to have the effects claimed by the conservative school. The point where they part from their fellows is merely this: The temperature changes in the sun appear to them to be accompanied by changes of other sorts. These other changes apparently act more rapidly and violently than the thermal changes. They may mask or even for a time reverse the thermal effects, but this does not mean that they are any more important. The variations in the sun's heat may be compared to the currents caused by the ebb and flow of the tide; the other variations, whatever their origin, may be compared to the waves and currents raised by the wind. Both sets of activities must be understood in order that a ship may safely reach harbor. The sun's non-thermal changes apparently act directly upon the earth's atmospheric activity. Hence the radical school holds that the more noticeable effects of solar variations *begin with the circulation of the air* and thus produce changes in temperature, ocean currents, rainfall, and the like.

Means of Settling the Controversy

In order to settle the controversy between the conservative and the radical meteorologists four lines of investigation suggest themselves. First, we must study the earth's weather anomalies, that is the incidental variations such as the cold winter of 1917-18. In this way we must determine whether unusual climatic conditions begin with changes in the temperature of the earth's surface or with changes in the distribution of atmospheric pressure. The monograph by Professor Helland-Hansen and Dr. Nansen here under consideration is a study of this problem.

Second, we must carry on a more intensive study of the sun itself in order to determine how far the connection between its changes and those of the earth's atmosphere can be attributed to thermal conditions and how far it must be attributed to other causes. Such a study has recently been completed by the writer and will shortly be published in the *Monthly Weather Review*.

Third, if there seems to be ground for the radical opinion as to the importance of non-thermal solar variations, we must carefully review the sun's activities to see whether there is any sound physical basis for the idea that they can influence the earth's weather. The most elaborate attempt of this kind that has thus far been made is that of Veeder, which was recently described in these pages.[2] His results, interesting as they are, cannot be accepted as conclusive. When he wrote some twenty-five years ago, neither the science of physics nor our knowledge of the problems

[2] Ellsworth Huntington: The Geographical Work of Dr. M. A. Veeder, *Geogr. Rev.*, Vol. 3, 1917, pp. 188-211 and 303-316.

mentioned under the two preceding headings was sufficient to permit of final conclusions.

Finally, when the supposed physical cause has at length been determined, it will be necessary to measure its occurrence in the sun most minutely and accurately—a thing which presumably has not yet been done. Only when such measurements are available can we compare them with the weather and apply the final tests which will solve the present controversy.

The Latest Contribution to the Settlement of the Problem

Material and Method of the Monograph

Having thus surveyed the general outlines of the greatest meteorological problem of the present day, let us review the latest important contribution to it. Professor Helland-Hansen and Dr. Nansen, as we have seen, belong to the radical group. This, however, is not from any *a priori* theory, but because studies of the temperature of the Atlantic Ocean seem to them to leave no other alternative. Their monograph is one of the most careful meteorological studies ever made. It contains among other things a comprehensive and illuminating review of all the chief contributions to the subject of the sun's relationship to the weather. With this is a full bibliography which is sure to be of great value to the student. They also give tables relating to the temperature, barometric pressure, and wind of many parts of the Atlantic Ocean as well as of some other regions, such as Scandinavia and the United States.

The authors begin with an investigation of the distribution of temperature in the surface waters of the North Atlantic Ocean for the years 1898-1910. On account of the vast amount of labor involved, and also because this season gives the most accurate picture of the main changes from year to year, they limit themselves to three 10-day periods between February 3 and March 4, and three similar periods from March 15 to April 13. Data were collected from all the available ships' logs along the route from New York to the English Channel. Other data were used for the region surrounded by Norway, Iceland, and Scotland, and thence westward and southwestward, also for the oceanic region between Spain and New York and for areas in the equatorial Atlantic. In addition to this a great number of records from all parts of the world were drawn upon. In fact, one of the most impressive features of this monograph is its thoroughness.

Ocean Temperatures and Currents

The first question to be answered is whether there is any evidence that the temperature of the central parts of the North Atlantic varies in harmony with the temperature and rate of flow of the Gulf Stream and the Labrador Current. Surprising as it may seem our Norwegian authors

can find no clear evidence of this. That the Gulf Stream and the Labrador Current must have an effect upon the temperature of the Atlantic they by no means deny. The ordinary idea as to the effect of the Gulf Stream, for example, assumes that when unusually high temperature is found in a given area, it should gradually move eastward. The rate of movement has been supposed to be such that it takes a year or more for a given condition to pass from Florida to the neighborhood of the English Channel. Hence during the 60 days from the middle of the first to the middle of the last of the 10-day periods with which our authors work, the center of an unusually warm area, for example, should advance from a sixth to a tenth of the distance from Florida to the coast of France. Not once during the thirteen years covered by the investigation is this expectation realized. On the contrary, there is a pronounced tendency toward somewhat sudden and irregular changes. An excess of temperature is soon followed by a deficiency. This in turn may in a few weeks be followed by another excess. Moreover, the changes do not proceed gradually from west to east, but show a tendency to occur simultaneously over areas extending a thousand or more miles from east to west. As a result of this tendency we do not find a gradual change from above normal to below normal, or the reverse, as we pass from west to east across the ocean. On the contrary, the whole Atlantic, aside from the parts near the two continents, generally shows the same kind of departure. That is, at a given time all the central parts of the ocean are likely to be warmer or colder than normal, while the two borders vary in the opposite direction.

Having completed their study of the region between Europe and New York, Helland-Hansen and Nansen turn their attention to other parts of the world. They find, for example, that when the temperature is especially low along the route from New York to England, as occurred in 1904, the same condition prevails over a large part of the North Atlantic as well as over vast areas in other parts of the world. Moreover, so far as there is a progressive movement of warm or cold centers, it does not appear to coincide with the direction of the currents. For instance, in the eastern Atlantic changes in the surface temperature seem to progress from the Azores northeastward and thus across the currents.

Temperatures and Winds

Having found that short-period changes of temperature do not occur in accordance with what would be expected on the basis of ocean currents, the authors next investigate the winds. They find that over the North Atlantic the temperature of the water varies closely in harmony with the barometric pressure, that is with the strength of the winds. Off the coast of Norway, where the temperatures of the water and of the land have been supposed to be closely dependent on the Gulf Stream, a careful investigation shows that this is not the case. Of course in the long run a change in

the Gulf Stream would be important, but, so far as the short changes from season to season are concerned, it is the wind that counts. The temperature of the coastal waters and of the air over the land varies in harmony with the wind. At Stockholm the changes in temperature are almost identical with those on the western coast of Norway. Moreover, as a rule the changes at Stockholm come a trifle earlier than on the west coast. Therefore we seem forced to the conclusion that "the immediate general cause of short changes . . . is undoubtedly to be sought in the changes in the atmospheric pressure."

Widely Separated Regions

This conclusion leads our authors to still further investigation. In accordance with the method of 12-monthly overlapping averages so profitably employed by Arctowski they compare their curves for North Atlantic regions with those for other parts of the world. The relationships are extraordinary. In the first place a great body of data shows that places as remote as the North Atlantic in latitudes 40°–50°, the equatorial Atlantic, Batavia in Java, Arequipa in Peru, and Bulawayo in South Africa are subject to almost the same synchronous series of small changes of temperature. In other places such as Honolulu the curve of temperature is almost the reverse of the Arequipa type. Between the two types there is every gradation. Moreover, a curve may suddenly change from one to the other. Such was the case on a wide scale about 1896. At that time a marked change of type occurred not only in temperature curves but in those representing atmospheric pressure and wind. According to Lockyer, a corresponding change in the sun, as indicated by the spectroscope, occurred at the same time.

Significance of these Data

The significance of these many curves from all parts of the world lies in the fact that their uniform periodicity points to some great cause outside the earth. That cause can only be the sun. It can scarcely, however, be the changes in the amount of *heat* emitted by the sun. The reason for this belief is as follows: Changes in solar temperature must produce their greatest effect in those parts of the earth where the sun at any given season shines most nearly vertically or with the least hindrance from clouds. From such places the heat would gradually spread outward, especially in the direction of the prevailing winds or currents. Under such circumstances places farther and farther removed from the regions of greatest heating would show less and less effect, and the delay would be greater and greater as we get farther away from the starting point. In some cases this is what happens, and we may well conclude that under such circumstances we are dealing with the direct effect of changes in the sun's thermal radiation. Far more often, however, we find simultaneous changes in remote places with wholly different climatic characteristics. Thus at

the equator about 30° west of Greenwich the ocean off the west coast of Africa undergoes changes of temperature almost identical with those about 45° farther north and about 45° west of Greenwich, that is off Newfoundland. Half way between these two places, however, the changes of temperature are almost exactly the reverse. It is noteworthy that at the equator and in latitude 45° N. in the Atlantic Ocean *low* pressure prevails permanently, while in the intervening region there is an area of permanent *high* pressure.

Similar instances might be multiplied. They seem to show that Hildebrandsson is right in his idea of centers of action. Apparently solar activity produces two kinds of effects, one in areas of high pressure and the other in areas of low pressure. Therefore the curves showing the changes of temperature from month to month in the two regions are reversed. In intermediate regions there are likely to be transition types. In places near the limits of the various centers of barometric action, predominantly high-pressure conditions may prevail at one time and low-pressure conditions at another. Thus mixed types of temperature curves may be produced. In this way what seems at first to be a perfect chaos, full of interminable contradictions, falls into an orderly and systematic sequence. It falls into such a sequence, however, *only if we admit that the primary effect of solar changes is to cause variations in atmospheric pressure.* If the sun's variations are primarily thermal, the chaos still remains chaos.

Criticisms of the Authors' Conclusions

This general conclusion of Helland-Hansen and Nansen seems to be wholly in accord with the evidence. In certain minor respects, however, their conclusions are open to question. For instance, they conclude that at times of sunspot maxima the extremes of temperature from day to day and season to season are no greater than at other times. This is directly opposed to the conclusions of Hann, Liznar, MacDowall, and Easton, all of whom are quoted by our authors. It seems also to be opposed to the evidence presented in the book under discussion by the authors themselves. Their curves of the difference between the warmest and the coldest months in various parts of the United States show a considerable resemblance to the sunspot curve, especially when all sections of the country are combined. They show a still greater resemblance to the curve of solar protuberances.

Another point which seems open to possible criticism is the effort of the authors to find exact periodicities. Thus they speak not only of periods of 14 and 27 days due to the sun's rotation, but of periods of 4, 8, and 12 months, periods of 2, 2.7, and 3.5 to 4 years, periods of 5 to 6, 11, and 33 to 35 years, and many other periods which slip from the memory. It may be that all these periods are real. It is certainly most fascinating to work with them. Almost everyone who studies sunspots or the weather is

lured on and on by the way in which the same phenomena repeat themselves in cycle after cycle. Thus far the net result of studies of this problem seems to be that we have not discovered a single period whose duration and character are such as to make it of practical value. We talk about sunspot periods of 11 years, but they vary from 7 or 8 to 14 or 15 years, and no one can do more than guess as to the length of the next one. The fact seems to be that while the changes in the atmospheres of the earth and the sun are cyclic they are not periodic. That is, the same phenomena keep recurring in cycles of every conceivable magnitude, but they do not recur after the lapse of any definite period. Every one of the apparent periods prevails for a short time—that is for a few cycles or perhaps a score—and then disappears.

What Is the Real Character of the Sun's Activity?

The consideration of cycles leads to the part of the book which the critic is sure to seize upon. Helland-Hansen and Nansen fail to show as close agreement between solar and terrestrial changes as between terrestrial changes in widely separated parts of the world. Only where the temperature of large numbers of stations is compared with the area of sunspots according to Köppen's method do we find an unmistakable and uniform relationship, extending over a long period. The promptitude with which similar temperature changes appear at short intervals in corresponding pressure areas in remote and unconnected regions is enough to prove that we are dealing with the results of solar activity. Nevertheless the apparent relationship between sunspots and the terrestrial temperature or pressure at individual stations keeps breaking down. The same is true when curves for solar prominences or for variations in magnetic intensity are substituted for sunspots. Each of these types of curves shows certain marked resemblances to the meteorological curves, but none shows the resemblances through long periods. The curve for the solar constant is equally unsatisfactory. In none of these cases, however, is there cause for surprise, as our authors well show. The fact is that although the relation between the sun and the earth seems proved, we do not yet know with what kind of solar activity we are dealing. The active agency is apparently not sunspots themselves, it is not the sun's magnetic action, it is not solar prominences, nor is it the solar constant. Each of these doubtless has some effect. Each is probably closely related to the force for which we are searching. Possibly all these solar phenomena are in themselves merely the effects of some greater, deeper cause, which also acts upon the earth's atmosphere. The authors have done the first part of their work so well that it is to be hoped that they will now take up this next step in the great problem of the relation of the sun to the weather.

THE RAINFALL OF JAVA

By MARK JEFFERSON

The strong influence of relief on rainfall is well known. Hellmann's superb "Regenkarte von Deutschland"[1] renders Germany the best of all examples, with its 3,000 stations in a land of 209,000 square miles, just as South America is the worst, with its less than 500 stations in a continent of 7,000,000 square miles area. Dr. W. van Bemmelen, director of the meteorological observatory at Batavia, has actually outdone the German record in a recent work on the rainfall of the interesting island of Java,[2] citing 1,060 rain stations in an island of 50,000 square miles area. Of course Java's position close to the equator and the high relief of this island of volcanoes make this study one of especial interest. Dr. van Bemmelen refers to a map of rain distribution in Java that he published in 1908, with fewer stations and a shorter series of observations. He did not then venture to draw isohyetal lines—their complexity being obvious—but printed the rainfall numbers on the spot of observation upon a map showing the relief of the island. The result was not very expressive. To be sure one could manage to make out by studying this map the relation between the rainfall and the relief, but only by close and painstaking study. The total result of such study is precisely what would have been shown much better and apprehended more readily by isohyetal lines.

Now that the author has more stations and a lengthened series of observations he has attempted to draw isohyetals on a coarse scale for the whole island, with very interesting results. As the work is not likely to be generally accessible, the three principal maps are here reproduced. The atlas contains seven maps on the scale of 1:1,500,000, with the exception noted: (1) shaded relief, 1:1,000,000; (2) mean annual rainfall in tints with isohyetals for 1, 1½, 2, 3, 4, 5, 6, 7, and 8 *meters;* (3) mean *monthly* rainfall for July, August, and September in tints with isohyetals for 2½, 5, 10, 20, 30, 40, and 50 *centimeters;* (4) mean monthly rainfall for December, January, and February in the same tints; and (5), (6), and (7) the same for October-November, March-April, and May-June. The relief map further indicates the location of all rain stations and the boundaries of the Residencies.

Our Figure 1a shows the mean annual rainfall of Java for the extra-

[1] 1:1,800,000, Reimer, Berlin, 1906; also accompanying G. Hellmann: Die Niederschläge in den norddeutschen Stromgebieten, 3 vols., Reimer, Berlin, 1906.

[2] W. van Bemmelen: Uitkomsten der Regenwaarnemingen op Java. Uitgegeven in opdracht van het Gouvernement van Nederlandsch-Indië, xxiii and 173 pp., Batavia, 1914; with "Regenatlas," 7 plates, Topografische Inrichting, Batavia, 1915. See also the discussion by B. C. Wallis in the *Scottish Geogr. Mag.*, March, 1917, pp. 108-119.

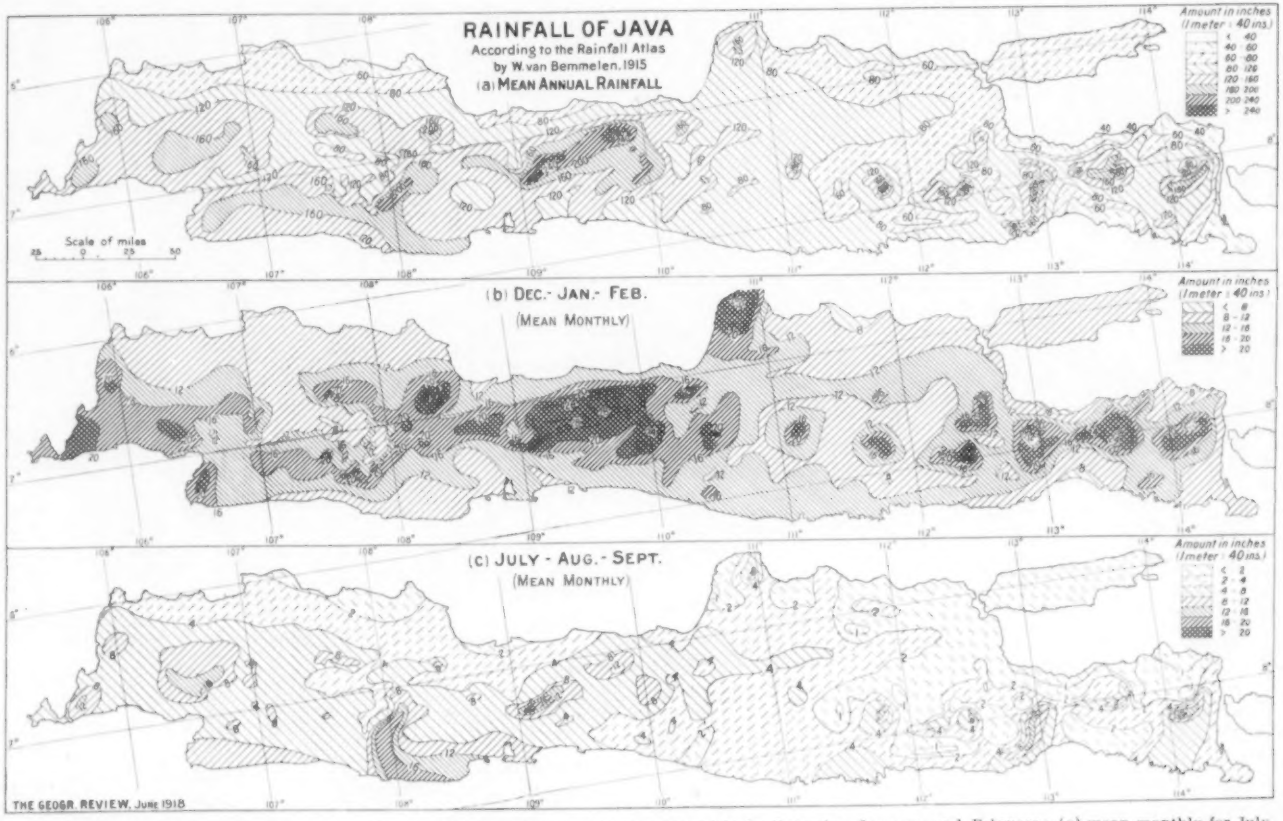

FIG. 1—Three maps showing the rainfall of Java: (a) mean annual; (b) mean monthly for December, January, and February; (c) mean monthly for July, August, and September. Scale, 1:11,500,000. Based respectively on Pls. II, III, and VI of van Bemmelen's rainfall atlas of Java, 1915 (for title see footnote 2).

ordinary interval of 40 inches, which we have put for van Bemmelen's meter, a coarser rain-grading than the reviewer ever encountered and quite appropriate to this land of giant relief and enormous rainfall. The maximum rainfall reported for one year is 332 inches (8,305 mm.) at Kranggan in Banjoemas Residency, among the west-central mountains, and the least is 35 inches (882 mm.) at Asembagoes in Besoeki Residency, at the northeast corner of the island. Decidedly Java is wet. Remember that Cherrapunji has but 474 inches and that the new coast record at Cape Anjeles in southern Chile hints at barely 500 inches for the southern Andes. The mean annual rainfall on the west slope of the mountain mass, G. Slamet (109° E.), is 320 inches.

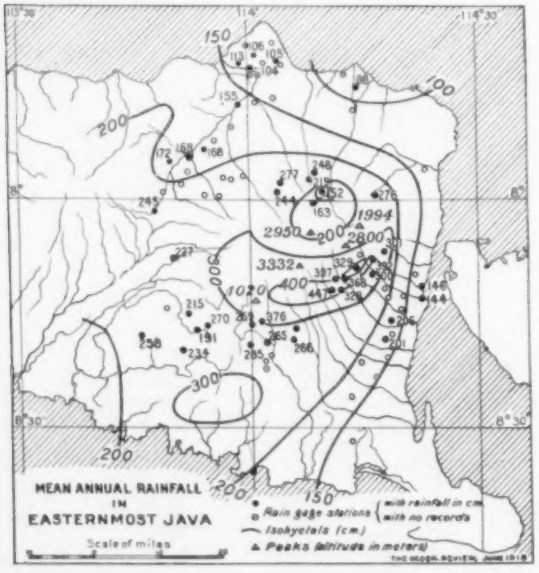

FIG. 2—Map showing in detail the mean annual rainfall at the eastern end of Java. Scale, 1:1,700,000. The rainfall amounts were plotted according to the text accompanying the atlas (see footnote 3) and the corresponding isohyetals were then drawn. These show that the isohyetals on the maps in the atlas are rigidly based on the records (cf. Fig. 1a).

Figure 1a shows more than 200 inches of rainfall along the whole of that massif from 109° to 110° E. Eight smaller mountain summits attain the same amount at points scattered along the eastern three-quarters of the island, as indicated by the patches of darker ruling. The heavier rainfalls can be seen to the southwest of the main heights, with striking rain shadows to the northeast. Very striking rain shadows are near 7° S. and 108° E. (80-inch patches) and near 8° S. and 114° E. (60-inch patch). On this map the whole distribution of rainfall *looks as if* the rain came from southwesterly winds blowing against the mountain slopes. This is also the case with the rain map for December, January, and February (Fig.1b). In July, August, and September (Fig. 1c) much less rain falls, and it looks rather as if it came on a southeasterly wind.

In neither case is there good agreement between the appearance of the map and the prevalent winds, which would seem to indicate that the rain falls from exceptional winds rather than from the prevalent ones, as it does in most parts of the United States and in many other parts of the world.

Our Figure 2, based on the text,[3] gives the actual figures used in drawing the isohyetals in Besoeki Residency among mountain masses ranging from 1,020 to 3,332 meters and seems fully to justify Dr. van Bemmelen's isohyetals. The complexity of these Java lines of equal rainfall contrasts admirably with the smooth ones of South America, where advancing knowledge has yet to put many a crook in the lines. The reason for using mean *monthly* instead of quarterly values of rainfall in the seasonal maps is that the seasons here made use of are of unequal length—two, three, and four months. The text contains abundant tables and discussions in English as well as Dutch.

[3] Pp. 73, 75, 77, 79, upper half.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Award of the David Livingstone Centenary Medal to Colonel Rondon. At a special meeting of the Society, on May 15, at Carnegie Hall, Fifty-seventh Street and Seventh Avenue, the David Livingstone Centenary Medal for 1918 was awarded to Colonel Candido Mariano da Silva Rondon of Rio de Janeiro, Brazil. The occasion was made noteworthy by the addresses of His Excellency Senhor Domicio da Gama, the Brazilian Ambassador, and Colonel Theodore Roosevelt, and by the presence of a large number of distinguished guests, including the members of the Brazilian Military Commission to the United States.

President Greenough presided. In introducing the Brazilian Ambassador, Mr. Greenough spoke as follows:

"As President of the American Geographical Society I have been asked to say an introductory word, and it shall be very brief. The purpose of the meeting is twofold. First, to view the picture exhibit prepared and presented now for the first time by the Brazilian Government for the American public. I shall not enlarge upon this subject for the reason that our distinguished fellow-geographer who is to address us will comment upon it and he always illumines every matter upon which he touches. I confine myself to an expression of the gratification felt by our Society that we have been selected by that Government as the medium for initiating its enlightened undertaking, together with our profound appreciation of the honor conferred by His Excellency the Ambassador from Brazil by assisting in our proceedings tonight.

"The second incident of the meeting is the bestowal of the Society's gold medal upon Colonel Rondon, the eminent geographer and soldier of that great republic. The language of the award inadequately summarizes his many accomplishments, but it reads as follows:

'To Colonel Candido Mariano da Silva Rondon of Brazil,

'During a prolonged period spent in the service of his country he has contributed more than any other investigator to an accurate and extended knowledge of the geography and resources of its interior. His explorations as Chief of the Brazilian Telegraphic Commission inaugurated the development of vast territories with great advantage to his government and to his people.'

"In the absence of Colonel Rondon the Ambassador has kindly consented to receive the memorial in his behalf, and he has likewise promised a few remarks concerning the career of the recipient, his countryman. It remains therefore for me only to hand him the medal, with the Society's grateful acknowledgment of his courtesy, and to introduce to you His Excellency, Senhor da Gama, the Brazilian Ambassador."

In reply the Brazilian Ambassador spoke as follows:

"I understand that there is no modesty by proxy. Therefore my sentiment on receiving this medal in recognition of the services rendered by Colonel Rondon to geography and civilization is one of undiluted pride and gratification. I presume to know what my illustrious countryman would say if he were here in person. The difference between dreams and their realization may make a man feel undeserving before his own conscience. But an outsider, seeing the work done, only can admire it and applaud any mark of appreciation of these same results that seem so poor when gaged by that mighty desire that impelled the man into action. In other words, I think that Candido Mariano da Silva Rondon fully deserves the honor that is bestowed upon him by the American Geographical Society, and my gratitude even hesitates between the giver and the receiver, the one for having conquered, the other for generously conferring the prize for his deeds.

"I shall not try to explain to you the Brazilian point of view of the meritorious task undertaken by that military engineer, whose life has been one of practical and almost saintly philanthropy. Colonel Roosevelt knows that better and may tell you, with his personal authority and more to the point, what I could only faintly indicate.

"For he was there and saw Rondon at work among his Indians. I do not know much about Indians, unless it is that we used to call them wild, and some of them

really are; also that they are puzzling, as most simple things. But there are people who believe in Indians, believe that they are like ourselves, only different. You know what I mean. Colonel Roosevelt is one of those men whose heart is big enough to love men of other races. And loving them he goes around the world to see where and how they live. No wonder he happened to meet that other philanthropist, engaged in his assiduous task of opening telegraphic communications and reducing wandering savages into permanent villages, in the backlands of Brazil. He met him, they became friends and did great things together. From our ungrateful Amazonian jungle Colonel Roosevelt brought a beautiful book, and a bad fever that almost killed him. Even if the book remained, it would be too high a ransom for the joy of a beautiful adventure and a good action.

"Ladies and gentlemen, we Brazilians owe to your ex-President a debt of eternal gratitude. He knew that we existed and wanted to see us at home and, because he liked us, wrote about our land and our men and their work for the good of that land, spoke of such as Osvaldo Cruz and Rondon as representatives of a spirit that would honor any nation, and it was as though we were shown to ourselves. The river Roosevelt, put on the map after its exploration by the scientific commission Roosevelt-Rondon, is not the only mark left of his visit to Brazil. The irresistible attraction of his generous and sympathetic disposition created among us a desire to return in deeds the credit that he gave to our people of being humane and progressive. The man who shared with Candido Rondon perils and glory is the more competent to speak to Americans of their common work under the equator, a work which cemented a friendship that we look on as a symbol of the friendship between our nations."

Thereupon President Greenough, in introducing Colonel Roosevelt, said:

"We are now to listen to an address by our eminent fellow-geographer and medalist, but we cannot forget that he stands at the same time pre-eminent in the nation's regard as statesman, as soldier, and as an inspiration to action and to sacrifice, in this crisis of our country."

Colonel Roosevelt delivered the principal address of the evening, giving a thorough review of the work of Colonel Rondon and his associates on the Brazilian Telegraphic Commission. He commented particularly upon the philanthropic character of Colonel Rondon's work and the large share of credit he deserves not only in the organization and conduct of the Roosevelt-Rondon Expedition of 1914, but also in opening up the interior of Brazil through the building of telegraph lines and the development of the natives. Colonel Roosevelt gave a brief description of the principal regions covered by his own expedition and the government expeditions of Colonel Rondon, which were fully illustrated by the moving pictures that were subsequently shown. In closing, he paid a graceful tribute to the modesty and courage of Colonel Rondon and to his extraordinary ability in gaining the confidence of the savages and inducing them to adopt more settled ways of life.

The representative of Colonel Rondon, Mr. Luiz Reis, followed Colonel Roosevelt's address with an exhibition of a series of moving pictures showing the interior of Brazil, native fishing operations, river navigation and a number of ritualistic ceremonies and dances of the Parecí, Nhambiquara, and Coroado Indians. The pictures were remarkable for their originality and scientific value and were accompanied by interpretative music.

In addition to the special music there was also a musical program consisting of the Brazilian national anthem and a Brazilian composition entitled "Guaraní" by Gomez, as well as the national airs of the Allies.

NORTH AMERICA

The Social Relations of Forestry. Exploitation of our forestal resources still remains a notorious example of that destructive economy well described by the German term *Raubwirtschaft* (Ernst Friedrich: Wesen und geographische Verbreitung der "Raubwirtschaft," *Petermanns Mitt.*, Vol. 50, 1904). With the physical consequences of forest devastation we have been made familiar; certain economic results are obvious; but little attention has been paid to social effects. Yet the forest directly concerns a large percentage of the population of the country: the last census accredits the lumbering industry with its allied branches of logging, milling, and manufacture with the employment of over 900,000 persons or 13.7 per cent of the wage-earners of the country. (S. T. Dana: Forestry and Community Development, *U. S. Dept. of Agric. Bull. No. 638*, Forest Service, 1918.)

Because of its destructive method lumbering remains a roving industry employing

nomadic labor. The lumberjack, for whom a permanent home and normal family life are impossible, falls in the same class as the nomad prospector of minerals. In many ways the present form of our forestal industry closely resembles mining. Like mining it creates the "mushroom" town. A good example is described by Mr. Dana. In 1893 five or six families were living on the site of Cross Fork in a then wooded spot of the strongly dissected plateau of northern Pennsylvania. Lumbering commenced. Around the big saw-mill grew up a town of 2,000 people. Prosperity lasted as long as the lumber supply. In 1909 the saw-mill shut down, the railway ceased running, and today Cross Fork is a hamlet of 60 persons. Similar instances may be found all along the trail of lumber exploitation from east to west. Only where agricultural lands strongly predominate or where there have been opportunities for industry along new channels have towns and cities built on lumbering survived. Abandoned farms may frequently be seen in the vicinity of such deserted villages. Sometimes farming has only been practicable with the forest as a supplementary source of income; sometimes it has been the matter of a local market. Even where forested land is suitable for agriculture hasty removal of the forest is to be deprecated. In Wisconsin there are 10,000,000 acres of cut-over lands of which three-quarters may be classed as agricultural but at the present rate of improvement it will be 150 years before they are brought under cultivation. In the meanwhile the land might be producing from one to three timber crops. Another social ill to which the cut-over land is peculiarly open is speculation and fraudulent land dealing. The history of the delinquent tax lands of the Michigan sand barrens is an eloquent example.

In opposition to the anti-social consequences of treatment of the forest as a "mine" are the possibilities of community development under treatment of the forest as a "crop," that is by true forestry. This will require a revolution of the present system. There will be needed an adequate system of land classification, recognizing economic as well as physical conditions, and a stable forest policy.

A New Agricultural Census in Connecticut. With the view of ascertaining roughly the agricultural outlook in its territory this year, the Litchfield County (Conn.) Farm Bureau undertook a farm survey of the county along original lines. The results were so helpful and the information secured so timely that the survey will probably be continued annually.

The survey was made by the local farmers in each town, under the general direction of county supervisors, each of whom was responsible for two towns. No questions were asked that dealt with values. The plan of the survey was to find the actual stock conditions for 1917 and 1918 and the acreage of significant crops for last year and in prospect for this year. Every farm of over five acres was listed, and the results were tabulated by the State Library at Hartford. The State Council of Defence supported the work in many ways, especially through printing the necessary blanks and in the appointment of the town chairmen of the local census enumerators. The actual enumeration was done by the farmers, all within one week.

The most significant problem before the county this year is the raising of small grains for home and stock use. The census has shown that there will be 10,500 acres of small grains this year in the county—an increase of 70 per cent over last year. The acreage of corn, oats, rye, wheat, barley, and buckwheat is also known.

With these facts in hand, the County Farm Bureau and others interested have taken up a detailed survey of harvesting, threshing, and milling machinery, with a view to the best use of the same at the proper season.

The census proved so successful that three other counties of the state later took farm censuses in a similar way. The results obtained are sufficiently accurate for the use that is to be made of them. This year's experience will make the next census still better and perhaps assist in making the 1920 National census more satisfactory, at least with reference to agricultural items.

The unique feature of the survey was that it was carried out by local men, who knew local conditions and realized the practical results to be obtained. Each step in the preliminary organization was taken according to a regular schedule so that there was no delay in carrying out the details. R. E. Dodge

Sea Breeze on Long Island. Long Island offers peculiarly favorable conditions for a study of the sea breeze, and it is somewhat surprising that up to this time no important local investigations of this interesting wind have been published. The results of observations made by means of a thermograph at Mecox, about two miles south of the village of Bridgehampton, Long Island, have recently been charted and discussed by Ernest S. Clowes (*Monthly Weather Rev.*, Vol. 45, 1917, pp. 345-346). The distance of the instrument from the ocean was about a quarter of a mile by the shortest line and

about one-half to three-quarters of a mile in the prevailing direction of the sea breeze (southwest). The effect of the sea breeze upon the temperature curve is rather slight, but distinctly noticeable. A curious flattening of the curve between 8 and 9 P. M. is characteristic. Some days show a higher temperature at 9 than at 8 P. M. This results from a cessation of the sea breeze about sunset and a turn of the wind toward the land.

R. DEC. WARD

California Coast Fogs. The importance of fog in navigation along the California coast is strikingly evidenced by the following fact. The Marine Exchange of the San Francisco Chamber of Commerce was asked what proportion of the shipwrecks which occur along the coast of California are due to fog. The answer was, "All of them." High winds and violent storms are rare. Fogs are the greatest danger to navigation. They are the chief contributory cause of the majority of marine disasters. Recent extensions and improvements of the fog-reporting service of the Weather Bureau have made possible a more detailed and more accurate study of fog conditions than could be made until now. Mr. Andrew H. Palmer, of the U. S. Weather Bureau at San Francisco, has prepared some new statistical tables and has briefly discussed the data ("Fog along the California Coast," *Monthly Weather Rev.*, Vol. 45, 1917, pp. 496-499).

Two types of fog have long been recognized on the California coast, summer fogs and winter fogs. In summer a fairly persistent fog bank hangs alongshore, extending seaward about 50 miles. The average vertical thickness is 1,500 feet. A vertical extent of 2,000 feet is rarely exceeded. During the summer months the excessive heating of the land causes an indraft of air from the ocean to the west. The inflowing wind reaches velocities of 25 or 30 miles an hour on summer afternoons near the Golden Gate. The westerly wind carries the fog onto the land, but it is usually dissolved, or becomes "high fog" or cloud before it penetrates far inland. These summer fogs seem to be due chiefly to the mixture of air masses which differ in temperature and in relative humidity. The temperature of the mixture is below the dew point, and condensation results. Along the coast there furthermore is an upwelling of cold water, similar, it may be noted, to the conditions off the coasts of northern Chile and of Peru, of northwestern Africa, and of the Somali coast. During the summer, with generally light winds, the air over this cold water is also cold and nearly saturated. The prevailing westerly winds, reinforced by the indraft towards the hot land, blow across this cold water. These westerly winds are themselvees nearly saturated but are slightly warmer than the cold air with which they mix. The mixture of these two air masses, both not far from their dew points, produces the condensation. These fogs seldom produce measurable precipitation, but are of great benefit to vegetation, as, for example, to the redwoods, which are limited to a narrow coastal strip in the fog region and never extend more than 30 miles inland. This summer type of fog sometimes occurs in winter but is rare then because the air is cooler than the water.

Winter fogs are of land origin. They are radiation fogs. They occur in all parts of California and occasionally move seaward, without going far offshore. They are thin (100-200 feet vertical extent); occur under weak gradients; and form at night. "Tule fog" is the local name for these winter fogs in California, because they are so frequent over swamps and marshes filled with tule (Mexican bulrush). Tule fogs last until they are "burned off" by the sun or are displaced by the wind.

R. DEC. WARD

SOUTH AMERICA

The Public Lands of Argentina. The problem of public lands in Argentina somewhat resembles that confronted by United States in the middle of the last century. A yearly immigration of some 300,000 people (pre-war figures) is fast filling up the already well populated districts about the ports of entry, while immense tracts of undeveloped lands lie idle in the interior. There are still about 240,000,000 acres of Argentine lands awaiting settlement. For some years the government has been attempting to induce colonization of these territories. By the law of 1907 farms of 250 acres each were offered to those who would occupy and improve them within two years. Pasture lands, unsuited to agriculture, were to be granted in blocks of 6,250 acres. In order to check speculation no person or corporation was allowed to acquire more than one pasture and two agricultural lots. A system of leasing made possible the temporary occupation of large grazing areas (*Bull. Amer. Geogr. Soc.*, Vol. 46, p. 441).

A new law, called by the English name "homestead," has recently been enacted (see *Commerce Repts.*, April 5, 1918). It is modeled on the lines of the homestead measure under which most of our western states were settled. If left as now approved it should help to bring about an important reform in the Argentine land system.

Argentina, with its semi-arid prairies, has always been a land of large estates. Such

immense grants of grazing land were assigned to the favorites of the early Spanish conquerors that within less than a century after their arrival almost all the country that lay within reach of the great highways from Chile, Paraguay, and Alto Perú had been claimed by their descendants. During the colonial period there was little development of these estates except in the immediate vicinity of the scattered towns. Indians still occupied much of the country, while herds of wild cattle and horses roamed over the unfenced *pampa*. (For an account of the *pampa*, see the paper by W. S. Tower in the April, 1918, *Review*). In 1878, after successful campaigns against the Indians had opened up extensive tracts of new lands, politicians and military favorites profited by the opportunity of securing large grants as rewards for their services to the country. The high rents charged for farms near centers of population sent a wave of land seekers out over these recently acquired territories. The government sold land in blocks of a square league at a nominal price. Great numbers of new *estancias* were established, and wild speculation in real estate created many of the great Argentine fortunes. For some twenty years this rapid expansion continued, but cattle raising for hides, tallow, and salted meat was the chief concern of the land-holders: a business that required extensive grazing estates. Only in 1898 did agriculture become of sufficient importance to demand a minister in the Cabinet. About the same time fine stock-breeding and dairying began to take the place of indiscriminate herding. These changes were made possible, if not actually brought about, by rapid growth of immigration. With the passing of the herdsman days there has come a marked tendency to divide up the great estates, particularly in the vicinity of the denser population centers. This is most noticeable in the province of Buenos Aires, where holdings of from 450 to 750 acres have grown much more common in recent years, and where there are many farms of even smaller size (see Argentine Year Book, 1915-1916, pp. 228-229).

The law recently passed is designed to prevent the creation of large estates in the regions to be settled. Each homestead is limited to from 50 to 450 acres, and is to be inalienable during the life of the recipient and until his children become of age.

Much of the country offered for homesteading is, moreover, purely agricultural rather than pasture land. Hence there will be less tendency toward the formation of large farms. In the Chaco and Misiones territories, where some 37,000,000 and 2,500,000 acres respectively are still open for settlement, yerba mate, tobacco, rice, and cotton can be raised. The Chaco is probably one of the most promising regions of South America for the development of cotton culture, as its climate and soil are well adapted to the cultivation of that plant. The territory of Chubut, in southern Argentina, about the latitude of New York State, will yield fruits and cereals, but, according to Bailey Willis ("Northern Patagonia," p. 290), its future industries will be chiefly dairying and high-grade cattle raising, for both of which it is well suited.

THE WORLD AS A WHOLE AND LARGER PARTS

The World Production of Hard Fiber. From time immemorial the Indians of Yucatan have used the native henequen fiber for the making of ropes, but the commercializing of this now famous Mexican product goes back only a few decades. Its present importance, indeed, may be said to date from the Spanish-American War, when the export of Manila hemp was temporarily cut off. Today henequen fiber supplies almost exclusively the ever-growing demand for binding twine, and the ancient Maya industry is now related to the wheat fields of the world. Troublesome times in Mexico together with the present world crisis have emphasized the dangers of such a monopoly (Paul V. Collins: America's Grain Imperilled, *Amer. Rev. of Reviews*, June, 1917).

The remedy is alternative. There is a possibility of extending the cultivation of henequen to other areas, or of substituting other fibers. The former method is already being pursued to some extent. Cuba has small amounts of fiber for export; so have some of the Central American countries, and one notes a proposed extension of the culture in Honduras (*Commerce Repts.*, July 17, 1917).

Other hard fibers now being produced are entirely consumed in the ordinary cordage and textile industries and in the extraordinary production of war material; supply barely meets demand, and prices have risen abnormally (*Commerce Repts.*, June 8, 1917). The world's production of hard fiber was distributed thus in 1915: abaca, or Manila hemp, 140,000 tons from the Philippines, 6,000 tons from Java; henequen or Yucatan sisal, 135,000 tons from Mexico, 3,000 tons from Cuba; sisal, Java 6,500 tons, Bahamas 4,300, British East Africa 3,750, Hawaii 1,000, Portuguese East Africa, 600 tons; phormium, 23,225 tons from New Zealand. The total of this estimated production is 317,975 tons. Perhaps the greatest promise for future development is held by East Africa. Before the war German East Africa, where cultivation had been introduced in 1893, led in the production of sisal, with an annual export of about 20,000 tons (none in 1915). In

British East Africa where commercial planting only commenced in 1907 progress had been satisfactory until the military campaign consuming an immense amount of native porter service drew labor away from the fields. With the resumption of more ordinary conditions and with large new areas now coming into bearing greatly increased production is anticipated from this region.

Worldwide attention is also being given to the production of new fibers. French West Africa reports an investigation of the "da" fiber (*Commerce Repts.*, June 4, 1917), while the North African colonies have great hopes for the successful utilization of their "alfa" grass. And there exist vast possibilities in Brazil not only for the utilization of the numerous wild fibers of the northern forests but also for the systematic cultivation of such fiber plants as those of the agave (sisal) species (*Commerce Repts.*, Jan. 26, 1916). The agave, a typical plant of the desert or semi-desert, suggests itself as a particularly appropriate product for the arid state of Ceará where periodic droughts cause temporary suspension of industry and enforce a general immigration. Besides supplying the market with cordage and twine the prospective Brazilian fiber industry might well be developed in relation to the greatest economic business of the country. A native fiber coffee bag could with advantage replace the imported jute article.

Successful experiments on sisal cultivation are also announced from the Italian Colony of Eritrea on the Red Sea (*Commerce Repts.*, July 26, 1917) and from Rhodesia, ("Fibres from Various Sources," *Bull. Imperial Inst.*, Vol. 15, 1917).

HISTORY OF GEOGRAPHY AND EXPLORATION

Exploration by Airplane. In his presidential address to the Geographical Section of the British Association for the Advancement of Science in 1916 (reproduced in the *Geogr. Journ.*, Vol. 48, 1916) Reeves estimated the area of the earth's surface unsurveyed and unmapped in any sense to be approximately one-seventh of the total (60,000,000 square miles). The major part of this unknown area lies in the Polar Regions; the remainder in continental interiors and tropical jungles. Final conquest resolves itself mainly into a question of transportation. The time element determined by transportation is all-important in initial geographical exploration, and by the means lately at our disposal it is but slowly that the explorer penetrates the ice-choked sea, the waterless desert, and the equatorial forest. Avoidance of the prime difficulties of the surface by travel through the air is not new as an idea; today it has become a practicable possibility. Already a pioneer aërial expedition is on its way to attack the heretofore unconquered interior of New Guinea. Its prospects have been described in the *Review* (Eric Mjöberg: A Proposed Aërial Expedition for the Exploration of the Unknown Interior of New Guinea, *Geogr. Rev.*, Vol. 3, 1917). Advantages of the airplane for exploration in Central and South America have recently been suggested by R. H. Millward (Exploring and Mapping Jungle Lands by Aeroplane, *Flying*, January, 1918). Mr. Millward spent five years mapping the forested department of Peten, Guatemala; he is convinced that with the aid of aërial transport the work might have been accomplished in four months and with a great saving in the toll on human life. Economically, too, by facilitating the reconnaissance of forestal resources and exploitation of mineral wealth the airplane would prove invaluable in such regions where extractive industry is in its early stages.

Turning to the other geographical extreme we find the use of the airplane in the Arctic advocated by Captain Robert Bartlett in consequence of experiences during his late voyage to Etah for the relief of the Crocker Land Expedition (Possible Aero Landing Places En Route to North Pole, *Flying*, October, 1917; cf. also article by B. M. Connell: The Aeroplane in Arctic Exploration, *Scientific American*, Sept. 30, 1916). Under the most favorable conditions water navigation in the far north must contend against the dangerous ice floe and frequently against surface fog. Aërial navigation would avoid these difficulties and further would shorten the trip. From St. John's, Newfoundland, to Etah is 3,000 miles by sea; by air line it is about half, or even by following deviations of the coasts to secure suitable landing places—a list of these at intervals of 50 miles is given by Captain Bartlett—the aërial journey would still be considerably shorter. To within 400 miles of the Pole suitable landing places could be established on terra firma; beyond, emergency landings could be made on the flat ice floes. And return might be made to Cape Chelyuskin on the Siberian side!

GEOGRAPHICAL NEWS

Foundation of the South African Geographical Society. On June 8, 1917, the South African Geographical Society was founded in Johannesburg. At the organizing meeting in the School of Mines Dr. G. S. Corstorphine occupied the chair, and Mr. J.

Hutcheon made an address on "Geography: Its Field and Its Future." In the course of his remarks Mr. Hutcheon explained that the objects of the society would be to raise the standard and safeguard the interests of the subject and those teaching it, to encourage geographical research in all its branches, and to arouse in the general public more enthusiasm therein. In time the society would, it was hoped, grant a diploma of fellowship (*South African Journ. of Sci.*, Oct., 1917, p. 136).

Personal

Mr. W. H. Babcock, president of the Anthropological Society of Washington, gave an address on "Some Anthropological and National Factors in the Present War" at a meeting of that society on April 23. Mr. Babcock has published several articles on the history of geography and cartography in the *Review:* "Atlantis and Antillia" (May, 1917); "Markland, Otherwise Newfoundland" (October, 1917); "Corvo, Our Nearest European Neighbor" (January, 1918).

Professor Albert Perry Brigham of Colgate University received the honorary degree of Doctor of Science from Syracuse University at its recent commencement.

Dr. W. A. Cannon, of the Department of Botanical Research of the Carnegie Institution, sailed in April to Australia and will be away from the United States about twelve months. He will visit certain of the more arid portions of West and South Australia, where he will make field studies of the desert plants with especial reference to root habits. Dr. Cannon published an article on "The Physiography and Vegetation of the Algerian Sahara," in Vol. 45, 1913, of the *Bulletin of the American Geographical Society.*

Professor T. C. Chamberlin, head of the department of geology at the University of Chicago, recently gave the Norman Wait Harris Lectures at Northwestern University. The general subject of the course was "Glaciers, Ancient and Modern," and the individual subjects were: "Birth, Growth, and Mature Stages of Glaciers"; "The Decadence, Death, and Residual Products of Glaciers"; "Existing Glaciation and the Place It Gives the Present Epoch in the Cycle of Climates"; "The Glaciation of the Last Geological Period"; "The Glaciation of the Earlier Geological Ages"; and "The Assigned Causes of Glacial Periods; The Climatic Outlook."

Mr. G. P. Engelhardt read a paper before the New York Entomological Society on April 16, entitled "Faunal Zones in Southwestern Utah."

Mrs. Laurie R. Frazeur lectured on May 10 before the Geographic Society of Chicago on "Mt. Robson and the Big Smoky River Country." She described two trips, one in the summer with horses, and the other in mid-winter with dogs, north of the Frazer River and Mt. Robson over the continental divide and down the headwaters of the Big Smoky River, which is the largest tributary of the Peace River. This region, some of it unexplored and some of it covered only by route surveys, was represented on the map of the Canadian Rocky Mountains between Jarvis and Yellowhead Passes, 1:300,000, published by this Society (*Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, facing p. 494).

Dr. E. O. Hovey of the American Museum of Natural History gave a lecture at Mount Holyoke College on February 20 entitled "Two Years' Experience in the Arctic with the Crocker Land Expedition."

Dr. Charles Keyes, of Des Moines, Iowa, has been chosen by the Democratic party of Iowa candidate for United States Senator to succeed Senator W. S. Kenyon, whose term shortly expires.

Dr. A. L. Kroeber, professor of anthropology in the University of California, read a paper before the New York Academy of Sciences on April 22 entitled "Factors Controlling Human Behavior as Illustrated by the Natives of the Southwestern United States." Professor Kroeber discussed the inherited social characteristics, the influence of local environment, and the historical development and contacts of definite civilizations.

Captain Lawrence Martin, National Army, associate professor of physiography and geography at the University of Wisconsin, is on duty in the Military Intelligence Section, War College Division, Office of the Chief of Staff, War Department, Washington, D. C. He has charge of the map room at the War College and of the maps in the offices of the War Council and of the Chief of Staff, and does geographical work for the General Staff in the Combat Branch of the Intelligence Service.

Dr. John Lyon Rich, of the Department of Geology at the University of Illinois, has been commissioned a captain in the National Army. He is assigned to Washington, D. C., for service in the Intelligence Branch of the army as a specialist in geography.

Dr. Rich is the author of the paper on "Cultural Features and the Physiographic Cycle" in the October, 1917, *Review*.

DR. P. A. SPEEK of the Library of Congress addressed the Anthropological Society of Washington on February 26 on "The Problems of Race and Nationality in Russia." An abstract of his paper is given in the *Journal of the Washington Academy of Sciences* of April 4.

SIR AUREL STEIN, since returning from England to Srinagar, Kashmir, has been engaged on the completion of "Serindia," the great final publication on his second expedition (1906-08), preparing the materials brought back from his third great journey (1913-16), and revising the drawings of the fifty map sheets on the scale of 1:500,000 which the Trigonometrical Survey of India has in hand for publication. This atlas will comprise all the surveys effected in Chinese Turkestan and westernmost China in the course of the three explorations. Its revision entails heavy labor, but there is every promise of satisfactory technical execution on the part of the Survey, and the atlas will add substantially to geographical knowledge (*London Times Literary Suppl.*, May 3, 1918, p. 205).

DR. C. D. WALCOTT, Secretary of the Smithsonian Institution and lately Director of the U. S. Geological Survey, was recently awarded the Wollaston Medal by the Geological Society of London in recognition of his contributions to geology and Cambrian paleontology.

PROFESSOR J. E. WOODMAN of New York University read a paper before the New York Academy of Sciences on April 15 entitled "Notes on the Physiography of Nova Scotia."

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

General

LAUT, A. C. **The conquest of the Great Northwest, being the story of the Adventurers of England known as The Hudson's Bay Company: New pages in the history of the Canadian North-west and Western States.** 2 vols. in one. Vol. 1, xxi and 409 pp.; maps, ill.; Vol 2, vii and 415 pp. Moffat, Yard & Co., New York, 1914. $2.00. 8½ x 6.

Part I, 93 pp. (1610-1631), deals with the four voyages of Henry Hudson and the adventures of Jens Munck and other Danes in Hudson Bay. The material is derived from original sources and is presented in a concise way. (The map facing page 22 in Vol. 1 needs revision with reference to the flow of the Polar Currents. The author's comparison between Dr. Nansen and Hudson and the description of driftwood and currents will not stand analysis.) Part II and the first portion of Part III, pp. 97 to 409 (1662-1760), treats of the explorations of Radisson in company with Groseillers and the first voyage of the fur hunters, which, under the leadership of Radisson, promptly brought into existence a company of gentlemen adventurers trading to Hudson Bay. These adventurers immedintely proved astoundingly successful and secured a charter from King Charles II to form the Hudson's Bay Company. This was the most remarkable charter ever issued, since it deeded practically all of modern Canada, including the great Northwest and all of the United States west of the Mississippi River. "The purest piece of feudalism ever perpetrated on America . . . . . depending upon the idea that the earth was the Stuart's, to be disposed of at will."

Next came the French raiders, under the leadership of d'Iberville, a leader at once wily and resourceful, secretly backed with the power of the French King. The exploits of Radisson and d'Iberville deeply involved the diplomacy of the English and French courts with plot and counter-plot. General histories covering this period omit the very material necessary for the full rehearsal of those important events. This material is supplied in the present work and is a sufficient reason why this volume should find a prominent place in libraries of history as well as of exploration. It is densely packed with data from original sources, with full references.

The times were troublous. More than one naval engagement was fought in Hudson Bay. Forts were captured, sacked, demolished; recaptured, rebuilt, resacked; only to pass again through the same stirring cycle of changes. As the sable, under Yermak, gave vast Siberia to Russia, so the beaver, in the hands of the Hudson's Bay Company, gave vast leagues of Canada to Great Britain.

Volume 2, consisting of Part III concluded and Part IV (1810-1870), deals with the real conquest of the Great Northwest—its exploration and beginnings of settlement. Indeed, so thoroughly did runners, guides, trappers, and special explorers overrun this entire territory, that not a stream where a beaver could float a stick, not a pond where he could build a house was overlooked. It is within the bounds of probability that every portion of the Great Northwest, including the northern tier of the United States west of the Mississippi, British Columbia, Saskatchewan, and the vast mountain ranges to the Arctic Ocean was known to agents resident oftentimes for long intervals at the several forts which were scattered through the territory. The country was surely well known to the trappers; nothing was left virgin for modern explorers.

This period of exploration and conquest was not confined to the present bounds of Canada, but covered Wisconsin, North Dakota, Montana, Idaho, Wyoming, Nevada, Utah, Washington, Oregon, and California. The stories of events within this long period are not so much a history of the times as they are the biographies of such intrepid leaders as Mackenzie, MacTavish, Thompson, Frazer, Astor, McGillivray, MacDonald, Robertson, Selkirk, Simpson, and Lord Strathcona. In a broader sense the entire story of the discoveries, the explorations, and the subjugations is but the summary of the biographies of Hudson, Radisson, d'Iberville, Selkirk, and Strathcona. The work has much to commend it, especially the many pages of notes, and the fact that "tons of Hudson's Bay records were examined as original data for the compilation of the book."

W. S. C. RUSSELL

SWANTON, J. R., AND R. B. DIXON. **Primitive American history.** Reprinted from *Amer. Anthropologist*, Vol. 16, 1914, No. 3, pp. 376-412.

A critical examination of the migration history of the various tribes north of Mexico, based on native tradition and the earliest historical record. The conservative treatment of the authors lends great weight to their final conclusions, which merit quotation at length: "The tribes of several of our stocks may be referred back to a swarming ground, usually of rather indefinite size but none the less roughly indicated. That for the Muskhogeans, including probably some of the smaller southern stocks, must be placed in Louisiana, Arkansas, and perhaps the western parts of Mississippi and Tennessee, although a few tribes seem to have come from the region of the Ohio. That for the Iroquoians would be along the Ohio and perhaps farther west, and that of the Siouans on the lower Ohio and the country to the north, including part at least of Wisconsin. The dispersion area for the Algonquians was farther north about the Great Lakes and perhaps also the St. Lawrence, and that for the Eskimo about Hudson Bay or between it and the Mackenzie River. The Caddoan peoples seem to have been on the southern plains from earliest times. On the North Pacific coast we have indications that the flow of population has been from the interior to the coast. This seems certain in the case of the Indians of the Chimmesyan stock and some Tlingit subdivisions. Some Tlingit clans, however, have moved from the neighborhood of the Nass northward. Looking farther south we find evidence that the coast Salish have moved from the inner side of the coast ranges, while a small branch has subsequently passed northward to the west of it. The Athapascan stock in all probability has moved southward, sending one arm down the Pacific coast and a larger body presumably through the Plains, which reached as far as northern Mexico. Most of the stocks of the Great Plateau and of Oregon and California show little evidence of movement, such indications as are present, however, pointing toward the south as a rule. The Pueblo Indians appear to have had a mixed origin, part of them coming from the north, part from the south. In general there is to be noted a striking contrast between the comparatively settled condition of those tribes west of the Rocky Mountains and the numerous movements, particularly in later times, of those to the east."

DOUGLAS, W. B., edit. **General Thomas James' three years among the Indians and Mexicans.** 316 pp.; map, ills., bibliogr., index. Missouri Historical Society, St. Louis, 1916. $4.50. 9 x 6½.

KROEBER, A. L. **Tribes of the Pacific coast of North America.** *Proc. 2nd Pan American Sci. Congress, Dec. 27, 1915, to Jan. 8, 1916*, Vol. 1, Section 1: Anthropology, pp. 22-37. Washington, D. C., 1917.

UNITED STATES

North Atlantic States

GOLDTHWAIT, J. W. **Evidence for and against the former existence of local glaciers in Vermont.** Maps, ills. *Repts. of the State Geologist on the Mineral Industries and Geol. of Vermont*, Vol. 10, 1915-1916, pp. 42-73. Burlington, 1916. [It is the author's opinion that local alpine glaciers have never existed in the Green Mountains. The supposed evidences, striae, "terminal moraines," etc., previously brought forward are to be explained by the ordinary operations of the continental ice sheet. Moreover cirques and other signs of local ice action are wanting from the higher summits where they would naturally be found had climatic conditions ever proved suitable. But the climate at the close of the glacial period in Vermont appears to have been too mild for the development of local snow fields and alpine glaciers. In the light the study throws upon the climatic conditions of the period the problem has more than a local interest.]

HATCH, LAURA. **Marine terraces in southeastern Connecticut.** Diagrs., ills. *Amer. Journ. of Sci.*, No. 262, Vol. 44, 1917, pp. 319-330.

JEWETT, A. L. **Official publications of the state of New York relating to its history as colony and state.** 62 pp.; bibliogr., index. *New York State Library Bibliogr. Bull. 59 (=Univ. of the State of New York Bull. No. 635)*. Albany, 1917.

JOHNSON, E. R. **The economic causes of New York's supremacy.** Ills. *New York Evening Post: Greater Port of New York Suppl.*, June 20, 1917, pp. 2-4. [Abstracted in the August, 1917, *Review*, Vol. 4, p. 145.]

KEIR, MALCOLM. **Some responses to environment in Massachusetts.** Maps, diagrs., ills. *Bull. Geogr. Soc. of Philadelphia*, Vol. 15, 1917, No. 3, pp. 121-138; No. 4, pp. 167-185.

MILLER, W. J. **The Adirondack Mountains.** 97 pp.; maps, diagrs., ills., bibliogr.,

index. *New York State Museum Bull. No. 193.* Albany, 1917. ["The purpose of this book is . . . . . to present in simple, nontechnical language a general outline of the geography, rock formations, physical history, and human history of the region." Sources for further study are suggested in the bibliography. Illustrations include small sketch maps and diagrams and many photographs: there is a location map and a generalized topographic map.]

OSTRANDER, J. E. **A summary of meteorological records for twenty-five years—1889 to 1913, inclusive.** *Massachusetts Agric. Experiment Station Bull. No. 153,* pp. 121-146. Amherst, 1914.

PARKINS, A. E. **The development of transportation in Pennsylvania.** Maps, ills., bibliogr. *Bull. Geogr. Soc. of Philadelphia,* Vol. 14, 1916, No. 3, pp. 92-114; No. 4, pp. 148-168; Vol. 15, 1917, No. 1, pp. 1-18.

PETERSON, A. E., AND G. W. EDWARDS. **New York as an eighteenth century municipality.** xxvii and 459 pp.; map, ills., index. (Studies in History, Economics and Public Law, Faculty of Political Science, Columbia University.) Longmans, Green & Co., New York, 1917. $5.00. 9 x 6. [In 1905 the minutes of the Common Council of New York for the pre-Revolutionary period were made available by printing and indexing. They form the indispensable source for this study, in which the geographer will find much interesting material, chiefly in the sections relating to trade and industry and transportation (growth of the municipal ferry system).]

—— **Pittsburgh, Pennsylvania, Report of Flood Commission of.** xv and 452 pp.; maps, diagrs., ills., bibliogr., index. Flood Commission of Pittsburgh, 1912. $10. 10½ x 8.

RICH, J. L. **An instance of the changing value of geographical location.** *Journ. of Geogr.,* Vol. 15, 1916-17, No. 6, pp. 185-189. [Hobart topographic sheet, at the head of Delaware River.]

RODDY, H. J. **Physical and industrial geography of Lancaster County, Pennsylvania.** vi and 113 pp.; maps, diagrs., ills. New Era Printing Co., Lancaster, Pa., 1916. 75 cents. 9½ x 6.

SARTORIS, ANTONIO. **Fra gli italiani emigrati nella Pennsylvania.** *Italica Gens,* Vol. 6, 1915, No. 3-6, pp. 132-135. Turin.

SEYMOUR, E. G. **New York City and the development of trade: A reading list.** 39 pp.; ill. Public Library, New York, 1914. 7 x 5. [Works of history and fiction illustrating the growth of the city from the discovery to the present day.]

SPILLMAN, W. J., H. M. DIXON, AND G. A. BILLINGS. **Farm management practice of Chester County, Pa.** 99 pp.; maps, diagrs., ills., index. *U. S. Dept. of Agric. Bull. No. 341.* Washington, D. C., 1916. [A tabulation and interpretation of data obtained from survey of operations of over 600 farms which should prove valuable in detailed regional study.]

TUCKER, F. B. **New York's military map of the year 1778.** Map. *Engineering News,* Vol. 75, 1916, No. 25, p. 1172.

UNDERHILL, R. M. **Ancient Long Island.** *Survey,* Vol. 35, 1915, Dec. 11, pp. 291-293. [Effects of long isolation are to be seen in the remote—or but recently remote—shore villages of Nassau County, Long Island. Manner of life is primitive; old traditions are preserved; the stranger is an object of suspicion; inbreeding, by intensifying defects, has produced a high percentage of feeblemindedness.]

WERNER, C. J. **A history and description of the manufacture and mining of salt in New York State.** 144 pp.; map, ills. Publ. by the Author, Huntington, Long Island, 1917. $15.00. 9 x 6.

MEXICO AND CENTRAL AMERICA

GARCÍA, GENARO, edit. **The true history of the conquest of New Spain, by Bernal Díaz del Castillo, one of its conquerors.** Translated into English, with introduction and notes, by A. P. Maudslay. Maps, ills., bibliogr., indexes. Vol. 1, lxv and 396 pp.; Vol. 2, xvi and 343 pp.; Vol. 3, 38 pp. (with maps and plans); Vol. 4, xiv and 395 pp.; Vol. 5, xv and 463 pp. (*Hakluyt Soc. Publs.,* 2nd Series, Vols. 23-25, 30, and 40.) The Hakluyt Soc., London, 1916. 9 x 6 each.

Bernal Díaz del Castillo was connected with the exploration and conquest of Mexico from beginning to end. He was with Córdova and Grijalva on their voyages along the coast of Yucatan. He served throughout the campaign against the Mexican empire and accompanied Cortes on the terrible expedition to Honduras. For fifty years he took part in the subjugation of the land. *Encomiendas* were granted him, first in Coatzacoalcos,

later in the *audiencia* of Guatemala. He attended the congress of Valladolid in 1550, and, unmoved by the humanitarian pleadings of Las Casas, voted that the *encomiendas* should be assigned to the conquistadores in perpetuity. Few of the stirring events of the conquest were unknown to this sturdy pioneer. Herein lies the value of his work.

A soldier rather than a scholar, Díaz del Castillo had not attempted to record his adventures until long after the conquest had been completed. Then he found it difficult to recall many details of the story. In spite of that his account has become one of the most important records of that heroic period. Antonio de León Pinelo and Enrique de Vedia, in their bibliographies, speak highly of his work. Herrera and Torquemada quote him frequently. Robertson depended upon his descriptions, and Prescott ranked his work as next in importance to Gomara's, while the Mexican historians, Genaro García, Vicente Riva Palacio, and Alfredo Chavero consider his account an indispensable contribution to our knowledge of early Mexican history. At least twenty editions of Díaz del Castillo's history have been published, in six different languages.

This is not the first English translation of the work. But Keatinge in 1800 and Lockhart in 1844 based their translations upon the text published by Friar Alonzo de Remón (Madrid, 1632), and that edition differed greatly from the original. The manuscript was preserved in Gautemala, and in 1904 Genaro García, having compared a written and a photographic copy of it, published the history in Mexico. Maudslay's work is a translation of that carefully prepared edition. The Spanish chroniclers were far from accurate at best, and as their accounts are the only source of information regarding those great voyages of discovery and conquest it is well worth while to preserve them exactly as written. This new translation is amply justified.

The first four volumes of Díaz del Castillo's history tell of the conquest of Mexico, including the early explorations of the coast of Yucatan and Tabasco. Volume 3 is devoted exclusively to maps. It contains the very interesting pre-Columbian plan of a part of Mexico City, made on maguey paper, with names of canals and causeways added in Spanish, probably soon after the conquest. A part of the fifth volume describes the remarkable expedition made by Cortes from Mexico to Guatemala and Honduras (1524-1526), in which he led an army of Spaniards and Indians over marshes, across rivers, and through dense forests in territory that even today can boast of few trails over which a horse can travel and must receive its mail and supplies by boat or by carriers on foot. For purposes of comparison a translation of Cortes' Fifth Letter to the Emperor describing this expedition is included in the volume; and the translator, having traveled over the region himself, charts the route probably followed by the conquistadores.

The country through which the Spaniards passed showed no signs of the higher Maya civilization. No well-built cities were encountered nor were any mentioned by the Indians along the way. The route followed must have been just beyond the frontier of Maya influence at that time. In Tabasco the natives lived in settlements beside streams or lakes, traveling only by watercourses. They were more helpless than the Spaniards when trying to cross the interfluvial spaces. Farther south among the mountains of Guatemala a somewhat higher culture was found. The people cultivated extensive fields of maize, kept poultry (probably turkeys), and possessed cacao plantations. They carried on extensive commerce between their principal towns, along well-established routes of trade by land as well as on streams. The traders mentioned by Cortes and Díaz del Castillo may have been the traveling merchants (*pochteca*), who often journeyed far from their guild towns on the Anahuac plateau, serving as pioneers for Mexican political expansion. Apparently they did not come from Yucatan. Maudslay concludes that the Maya civilization whose ruins are found in the region traversed by Cortes had declined long before this time. This accords with ideas advanced by Morley, who, from his recent studies of Maya hieroglyphs, estimates that the cities in the south had been abandoned about the end of the sixth century.

Mr. Maudslay has not acted simply as translator of this history, but has added notes on the geography and archeology of Mexico, which with the maps that accompany the work greatly enhance its value.

BARBERENA, S. I. **Informe de los servicios meteorológico y sismológico de El Salvador.** *Proc. 2nd Pan American Sci. Congress, Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 642-644. Washington, D. C., 1917.

—— **[Canal Zone] weather conditions for the year, 1917.** *Panama Canal Record,* Vol. 11, 1918, No. 23, p. 246.

G[ORDON], G. B. **The trail of the Golden Dragon.** [*Univ. of Pennsylvania*] *Museum Journ.,* Vol. 9, 1918, No. 1, pp. 29-38. [Relationship between myth and environment in Central America.]

HUNTINGTON, ELLSWORTH. **Maya civilization and climatic changes.** Diagr. *Proc. Nineteenth Internatl. Congress of Americanists held at Washington, Dec. 27-31, 1915*, pp. 150-164. [Smithsonian Institution], Washington, D. C., 1917.

LANDA, LUIS. **Estado actual de la meteorología y sismología en Honduras.** *Proc. 2nd Pan American Sci. Congress, Dec. 27, 1915, to Jan. 8, 1916*, Vol. 2, Section 2: *Astronomy, Meteorology, and Seismology*, pp. 727-730. Washington, D. C., 1917.

LÓPEZ, ELPIDIO. **Estudio sobre los estados del tiempo que corresponden a cada uno de los tipos de carta (primera aproximación) y para algunas regiones de la República Mexicana.** Maps. *Bol. Mensual del Observatorio Meteorol. y Seismol. Central de México*, 1916, No. 10, pp. 207-212. Sec. de Fomento, Colonización, e Industria, Mexico. [From a study of available records—very incomplete for certain sections—Mexican weather has been resolved into ten types. Each of these is represented graphically and is briefly discussed.]

LÓPEZ, ELPIDIO. **Influencia de los ciclones tropicales sobre el estado del tiempo en el Valle de México.** Map. *Bol. Mensual del Observatorio Meteorol. y Seismol. Central de México*, 1916, No. 10, pp. 203-206. Sec. de Fomento, Colonización, e Industria, Mexico. [From time to time extraordinary rainfalls have been recorded in Mexico City: in Sept., 1915, for instance, 3½ inches of rain fell in four hours. These are hurricane rains developing in the rear quadrant of the violent tropical cyclone. In the above article meteorological conditions during eight such storms are shown in tabular form, the paths of the storms being indicated on a map.]

MEANS, P. A. **History of the Spanish conquest of Yucatan and of the Itzas.** Maps, ills., bibliogr. *Papers of the Peabody Museum of Amer. Archaeol. and Ethnol., Harvard University*, Vol. 7, 1917, pp. 1-206.

—— **Mexico: General descriptive data.** 47 pp.; maps, ills. Pan American Union, Washington, D. C., 1916.

—— **Mexico's petroleum industry.** Ills. *Mexican Rev.*, Vol. 2, 1917, No. 1, pp. 4-7, 10-11, and 13.

MORLEY, S. G. **The rise and fall of the Maya civilization in the light of the monuments and the native chronicles.** Maps, ills. *Proc. 2nd Pan American Sci. Congress, Dec. 27, 1915, to Jan. 8, 1916*, Vol. 1, Section 1: Anthropology, pp. 192-208. Washington, D. C., 1917. [A series of eight maps shows the distribution of Maya civilization at the chief stages of its development. Hieroglyphic inscriptions provide a chronology for the Old Empire that flourished during the first six centuries of the Christian era in what now are the states of Chiapas and Tabasco in Mexico, the departments of Peten and Izabal in Guatemala and the adjoining western part of Honduras. The Old Empire terminated about 600 A. D. in a rapid decline of which the causes have been variously conjectured. Two conjectures have a special geographical significance. Cook has suggested exhaustion of the soil following primitive exploitation; Huntington, increased rainfall with stimulated growth of the natural vegetation to a degree against which Maya agriculture could not contend. A migratory movement northward during the last period of the Old Empire made the first stage of the cultural florescence in Yucatan; a renaissance of Maya civilization reached its apogee in the eleventh century. Sources for the history of the New Empire exist in the native chronicles.]

EUROPE

BALKAN STATES, INCLUDING RUMANIA

—— **Albania. Relazione della Commissione per lo studio dell'. Part I: Studi geologici,** by Giorgio Dal Piaz and Antonio De Toni; **Studi geografici,** by Roberto Almagià. 81 pp.; maps, diagrs., ills. **Part II: Studi agrologici,** by Umberto Rosati and Gaetano Baudin. 195 pp.; diagrs., ills. Società Italiana per il Progresso delle Scienze, Rome, 1915. Both vols. 5s. 3d. 11 x 7½.

To judge from the data gathered in these two volumes of the Italian Association for the Advancement of Science, a notable forward stride has been made in our knowledge of Albania in the course of the last decade. The country has not recovered from the devastating effects of Turkish misrule, and the backward state of its inhabitants is apparent when their social organization is compared with that of their neighbors. Yet the different reports forming the text of the present work indicate the existence of an economic foundation on which the building of a thriving Albanian state is possible.

Of particular interest is Professor Almagià's account of the geographical features which have conferred historical importance on Albanian harbors. The likelihood of a revival of commercial activity to be directed along the routes which formerly extended cross-country in an east-west direction is intimated. This is a favorite Italian concep-

tion. It needs, however, the test of application to prove whether ancient trade routes like the Via Egnatia will be able to compete with the better frequented north-and-south avenues of Balkan trade.

The authors believe in the possibility of promising developments in agriculture and call attention to results already attained in the vicinity of Valona by their countrymen as well as by Greek operators. The need of proper instruction in industrial methods of operation or exploitation is apparently most pressing. To offset this condition the authors suggest inviting Albanians to Italian institutions and the building of agricultural schools in Albania. The region described with greatest detail is western Albania between Valona and Durazzo. It is to be hoped that this investigation will be followed by a similar survey of the rest of Albanian territory. LEON DOMINIAN

ARABU, N. **Les régions voisines de la mer de Marmara.** Map. *Ann. de Géogr.*, No. 143, Vol. 26, 1917, pp. 353-375. [Sketch of the geological history.]

EREDIA, FILIPPO. **Sul clima di Salonicco.** Diagrs. *Boll. Reale Soc. Geogr. Italiana*, Vol. 5, 1916, No. 12, pp. 980-1006. Rome.

GAUTIER, E.-F. **La pointe de Sedd-ul-Bahr.** Map, ills. *Ann. de Géogr.*, No. 132, Vol. 23-24, 1915, pp. 433-437.

HAUMANT, ÉMILE. **La pays dinarique et les types serbes, d'après Mr Jovan Cvijić.** *Ann. de Géogr.*, No. 132, Vol. 23-24, 1915, pp. 407-419. [Abstracted in the *Review*, Vol. 3, 1917, pp. 324-325.]

MAREK, RICHARD. **Südost-Europa und Vorder-Asien: Griechenland.** *Geogr. Zeitschr.*, Vol. 22, 1916, No. 9, pp. 510-527.

NICOLESCO, MIRON. **Distribution géographique du pétrole en Roumanie.** Ills. *Atti X Congr. Internaz. di Geogr., Roma, 1913*, pp. 1194-1207. Reale Società Geografica, Rome, 1915.

PREZZOLINI, GIUSEPPE. **La Dalmazia.** 75 pp. Libreria della Voce, Florence, 1915. L. 1. 10 x 7.

RECHINGER, KARL. **Korfu.** 18 pp.; ill's. (Vegetationsbilder, Ser. 12, No. 4. Herausgegeben von G. Karsten and H. Schenck.) Gustav Fischer, Jena, 1914.

TÄUBER, C. **Meine Durchquerung der nordalbanischen Alpen im April 1914.** Ills. *Jahrbuch des Schweizer Alpenclub*, Vol. 50, 1914 and 1915, pp. 3-29. Bern, 1916.

WEISS, J. **Zur Verkehrsgeographie Serbiens.** Map, ills. *Österreichische Monatsschr. für den Orient* (herausgegeben von K. K. Österreichischen Handelmuseum in Wien), Vol. 41, 1915, No. 9-12, pp. 274-276.

WOODS, H. C. **The Salonika campaign.** *Scottish Geogr. Mag.*, Vol. 33, 1917, No. 2, pp. 65-73.

AFRICA

SUDAN AND UPPER GUINEA

BRUEL, GEORGES. **Bibliographie de l'Afrique Équatoriale Française.** iv and 326 pp.; index. Gouvernement Général de l'Afrique Équatoriale Française. Emile Larose, Paris, 1914. 10s. 10 x 6½.

M. Bruel is Chief Administrator of the colonies. This list of 7029 titles, classified by author and by periodicals (anonymous articles), covers the whole of French Africa south of the Sahara. Even a newspaper paragraph of a few lines is listed if it contains a date or other bit of information not found elsewhere. France has had a great number of official and volunteer investigators in the field; and this important work will give to students of French Equatorial Africa the same great service that Grandidier's "Bibliography of Madagascar" renders to students of that island.

CYRUS C. ADAMS

RAPHAEL, J. R. **Through unknown Nigeria.** xix and 361 pp.; ills., index. T. Werner Laurie, Ltd., London, [1914?] 8s. 6d. 9 x 6.

The title is somewhat misleading, for Barth was a standard authority on large areas of Nigeria a half century ago, and six or seven excellent books have appeared within the past twelve years, all dealing with one or another area that Raphael describes. The book gives many accurate impressions of the land, its peoples, and activities. The author has almost nothing to say about the production of cotton—an economic question of great interest in England.

There are frequent references to the Fulani and the Hausa peoples. The term Fula is preferable to Fulani, as the latter is merely the Hausa variant of the name. But every allusion to these peoples is merely incidental. The average reader gets no con-

ception of the fact that they are two of the most conspicuous races of Africa, very unlike each other, but both remarkable in their characteristics and history.

The author shows that the policy of Goldie and Lugard, in dealing with the Hausa and Fula population, is the guiding principle of the government today. The aim is to encourage and foster all that is good in the native life and to suppress only slave-raiding and other evil practices which retard development.

An extended account is given of Kano, the famous city of central Sudan and the focus of the whole Mohammedan population. The policy of the British, in that city and in all the provinces tributary to it, is to rule by and through the natives, leaving them to select their own emirs, who must, however, be approved by the British governor. The control of this enormous and intensely fanatical part of the population was a delicate problem, but the English have solved it, as is proved by the apparently complete acquiescence of the Mohammedans.

Kano is surrounded by a wall of dried mud, as hard as rock, eleven miles long, fifty feet high and forty feet wide at the base. The population of 30,000 has room in this enclosure for many fields and pastures. The mud houses are comfortable; even Europeans live in them, and the cheapest rent for a few dollars a year. The Kano market, famous throughout Africa, is the collecting and distributing point for trade between the central Sudan and the Mediterranean. The crowds at the market, on the busiest days, number from 10,000 to 12,000.

The chief Niger port has long been Forcados, at the mouth of one of the delta streams. It is greatly to the advantage of the Niger ocean trade that a new port has recently been built at Burutu, four miles up stream from Forcados, where two ocean vessels at a time may take on or discharge freight. CYRUS C. ADAMS

THIEROLF, HANS. **Neunzig Jahre Tschadsee-Forschung: Versuch einer historischen Darstellung des Tschadseebildes.** 81 pp.; maps, diagrs., bibliogr. Dissertation Universität Giessen, 1914. 9 x 5½.

A summary of the history and results of Lake Chad exploration from Denham (1823) to Tilho (1912-13). The reports and other publications on which the monograph is based include 43 titles. Summing up the scientific results, Dr. Thierolf says that the area of the lake has considerably diminished within the 90 years of observations, though the differing determinations of its size are undoubtedly due, in part, to the fact that some explorers have seen the lake at periods of comparatively small, and others at periods of unusually large precipitation. The long duration of the *harmattan* especially induces high evaporation. There is no reason to believe that the lake will disappear.

According to Tilho, the highest level of the lake is in December and the lowest in August, the difference between them being four-fifths of a meter. The channels in the lagoon regions, Tilho says, have an average depth of 2½ to 3 meters, but the mean depth in free water is less. Explorers have differed widely as to the "taste" of Chad's waters. Barth and Nachtigal both declared the water to be sweet; Dubois and Lenfant said it was sweet only at high water. Tilho says the water is brackish and its salinity increases with the distance from the mouths of tributary streams.

Nachtigal said that about 100 inhabited islands are strewn over a third of the lake's area. D'Huart found that all the islands have the same general direction from north-northwest to south-southeast and attributed this fact to the influence of the *harmattan* and of the current in the lake caused by the entering waters of the Shari River. He also distinguished three groups of islands: those that are inhabited and rise from 10 to 15 meters above lake level, those that are 4 to 5 meters high and are used as meadows, and the low islands that are only half a meter or less above the lake's surface.

CYRUS C. ADAMS

ADAM, J. **Le Djoloff et le Ferlo.** Map. *Ann. de Géogr.*, No. 132, Vol. 23-24, 1915, pp. 420-429. [Two regions of central Senegambia.]

ANGOULVANT, —. **La Côte d'Ivoire.** 131 pp.; map. Gouvernement Général de l'Afrique Occidentale Française, Bingerville, édit. of 1915.

BELTRÁN Y RÓZPIDE, R. **El porvenir de la Guinea española.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 6-7, pp. 256-258.

BROOKS, C. E. P. **The rainfall of Nigeria and the Gold Coast.** Maps, diagrs. *Quart. Journ. Royal Meteorol. Soc.*, No. 178, Vol. 42, 1916, pp. 85-106 (discussion, pp. 104-106). [Abstracted in the *Review*, Vol. 2, 1916, p. 378.]

—— **Cabo Verde, A mão d'obra agricola na provincia de.** *Bol. Soc. de Geogr. de Lisboa*, Ser. 34, 1916, No. 4-6, pp. 214-227.

—— **Cameroons and Togoland, The administration of the.** Maps. *Geogr. Journ.*, Vol. 48, 1916, No. 5, pp. 406-407. [With maps constructed from official com-

munications "in accordance with the best information as to the district boundaries now at the disposal of the Society."]

CHUDEAU, RENÉ. **Le climat de l'Afrique occidentale et équatoriale.** Maps, diagrs. *Ann. de Géogr.*, No. 138, Vol. 25, 1916, pp. 429-462.

CHUDEAU, RENÉ. **L'Ouadaï.** Bibliogr. *La Géographie*, Vol. 30, 1914-15, No. 4, pp. 292-294. Paris. [Summary of the physical geography of Wadai based on recent publications.]

CHUDEAU, RENÉ. **Quelques progrès en Afrique occidentale en 1915 et 1916.** *Renseign. Colon.* (*Suppl. à l'Afrique Franç.*), 1916, No. 10-12, pp. 257-261.

GIRONCOURT, G. DE. **La descente du bas Niger dans la zone des rapides.** Map, ills. *La Géographie*, Vol. 30, 1914-15, No. 4, pp. 251-256. Paris.

HUBERT, HENRY. **Progression du desséchement dans les régions sénégalaises.** *Ann. de Géogr.*, No. 143, Vol. 26, 1917, pp. 376-384.

HUBERT, HENRY. **Sur les climats de l'Afrique occidentale.** Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol 161, 1915, Aug. 9, pp. 142-144.

KITSON, A. E. **The Gold Coast: Some considerations of its structure, people, and natural history.** Ills. *Geogr. Journ.*, Vol. 48, 1916, No. 5, pp. 369-392 (discussion, pp. 391-392).

MARTIN, CAMILLE. **Togo et Cameroun.** 89 pp.; maps. Comité de l'Afrique Française, Paris, 1916. 2 fr. 9 x 5½.

PALADINO, GIUSEPPE. **Nuovi documenti dell'ultimo viaggio di Pellegrino Matteucci, 1880-1881.** *L'Africa Italiana*, Vol. 35, 1916, No. 10, pp. 227-236.

PHYSICAL GEOGRAPHY

GEOLOGY AND GEOMORPHOLOGY

WOLFF, FERDINAND VON. **Der Vulkanismus. 1. Band: Algemeiner Teil. 1. Hälfte: Das Magma und sein geologischer Gestaltungsvorgang. Die vulkanischen Erscheinungen der Tiefe. Der submarine Vulkanismus.** viii and 300 pp. **2. Hälfte: Die vulkanischen Erscheinungen der Oberfläche. Lunarer und kosmischer Vulkanismus. Geschichte der Vulkanologie.** pp. 301-711. Maps, ills. F. Enke, Stuttgart, 1913 and 1914. 10 x 6½.

These are the first and second parts of the first volume—one-half of the whole work when completed—of a modern scientific handbook on vulcanism, working up the latest researches of Rosenbusch, Van Hise, Brögger, Daly, Becke, and many others. The first volume explains the volcanic phenomena by the physical conditions under which they occur. The petrographical, physical, and chemical problems involved in volcanic processes receive special attention. Careful examination of these problems seems to prove that the direct causes of the eruptions are variations of pressure and temperature which disturb the chemical equilibrium of the magma. The author also discusses at some length the differences of the Atlantic and Pacific types of the magma. The former surrounds the Atlantic Ocean and forms the volcanic rocks of almost all the continents, and the oceanic islands; the latter surrounds the Pacific Ocean and forms also the volcanic rocks of the three Mediterranean regions.

In the oldest geological times the Pacific magmas dominated. The first Atlantic rocks are not discernible until the Silurian, and they do not noticeably increase before the end of the Palaeozoic era. Their domination begins in the Tertiary. It seems then that a gradual change of the chemical composition of the magma accompanies the geological history of the earth.

The submarine manifestations of vulcanism seem to be much more intense than those on the land. The existing volcanoes on the land continue to use craters of Quaternary or Tertiary origin, but on the floor of the oceans new ones are formed even in the geological present. Their connection with the magma is much more direct than that of the surface volcanoes, the temperature of those lavas which reach the surface (Hawaii, Samoa) having been found considerably higher than that of the land volcanoes.

The larger part of the second half of the first volume is devoted to the problems of surface vulcanism, followed by chapters on cosmic vulcanism and the history of vulcanology. The author distinguishes three classes of surface eruptions: linear, areal, and central. The last type, the most frequent in the geological present, is the one commonly understood by the word volcano. It may be an elevation or a depression (Hawaii). The three classes evidently correspond to three degrees of intensity of the volcanic forces, the areal eruptions being the strongest, the central the weakest type. In a normal

volcanic cycle the three succeed each other chronologically, as may be observed in the volcanic regions of Iceland, Ireland, and Scotland. In intrusive rocks, the neck represents the central, the dike the linear, the batholith and laccolith the areal, intrusion.

The author describes the phenomena and products of the different classes of eruptions, with many examples from all parts of the world, placing especial emphasis on the physical and chemical sides of the processes.

Considering the dominating part which the process of cooling of liquid silicates plays in all kinds of volcanic activity, vulcanism cannot be an exclusively terrestrial phenomenon, but must occur wherever in the universe magma passes from the hot liquid into the crystallized state, allowing such alterations as correspond to the different physical conditions of the respective celestial bodies.

The magma of the moon cannot be very different from that of the earth, because the average density of the two is approximately the same. But all the phenomena dependent on pressure and tension must show certain differences. On the moon the highest degree of contraction was on the actual surface, which, contracting more rapidly than the lower portions, suffered the great breaks whose effects are seen in the enormous faults and fissures which characterize the relief of the moon as well as the absence of folded mountains. Likewise the crust of the moon, not re-enforced by sedimentary masses, offered less resistance than the earth to the attack of the volcanic forces from within. Volcanic action on the moon could therefore be one single huge process which continued with decreasing intensity until it had exhausted itself, while on the earth there were repeated periods of volcanic action corresponding to periods of disturbances of the crust and of varying, though on the whole also decreasing, intensity.

It would not do, therefore, to consider the present state of the moon as an example of the probable future condition of the earth, because here the endogenous forces are opposed by the exogenous, and the latter must finally be victorious, reducing the topography to the peneplane stage which will never be reached on the moon on account of its lack of water and atmosphere.

The author has succeeded in presenting the extremely difficult matter in a lucid and unpretentious style intelligible to any student with the necessary preparatory knowledge, while the bibliographical references represent a small international library of modern vulcanology.

M. K. GENTHE

AZZI, GIROLAMO. **Sur les limites de la géomorphologie.** Diagrs. *Atti X Congr. Internaz. di Geogr., Roma, 1913*, pp. 886-896. Reale Società Geografica, Rome, 1915.

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ERRATA

p. 1, lines 13-14: *for* irrevocable *read* implacable.
p. 2, map: location of Limpa River (67° N. and 100° E.) and related Limpiisk Tundra is incorrect. Limpa River is a small tributary of the Lower Tunguska, entering it below the Syevernaya River in 66° N. and 88° E.
p. 55, line 23: *for* 95-centimeter *read* 95-millimeter.
p. 67, lines 7-8 of title under "Educational Geography": *change statement about insets as follows:* The physical and political map each with two insets, 1:75,000,000, the former with: (a) Natural Vegetation and Ocean Currents; (b) Mean Annual Rainfall and Prevailing Winds; the latter with: (a) Railway and Steamship Lines; (b) Population Density.
p. 150, lines 19 and 35: *for* Rabi *read* Ravi.
p. 150, line 18 from bottom: for *karif* read *kharif*.
p. 210, line 17: *for* A. E. Tameron *read* A. E. Cameron.
p. 240, line 3 of title of Fig. 1: *for* later routes or *read* later routes on.
p. 242, line 24: *for* phanton *read* phantom.
p. 333, lines 12-13 from bottom: for *Maude* read *Maud*.
p. 344, line 5 from bottom: *for* "February *Review*" *read* "January *Review*."
p. 346, bracketed line under title: *for* facing p. 360 *read* facing p. 358.

ADDITIONAL ERRATA IN PREVIOUS VOLUMES

Vol. I

p. 237, line 9 of review of Mission Tilho: *for* Vol. 43, 1913, *read* Vol. 43, 1911.

Vol. II

p. 46, line 9: *for* Trinok *read* Timok.

Vol. III

p. 396, line 3 of footnote 9: *for* Joly and Goegi *read* Dozy and De Goeje.

Vol. IV

p. 61, lines 3-4 of first item under Africa: for *Bull. Soc. de Géogr. de Paris* read *Bull. Soc. de Géogr. Commerc. de Paris*.
p. 321, line 23: *for* Sir Allan Young *read* Sir Allen Young.
p. 496, lines 20-21: *passage should read:* As first clearly delimited from surrounding parts of the coastal plain by Stone, the pine barrens are practically coextensive with the Beacon Hill (geological) formation.
p. 496, line 8 from bottom: *add* No. 4, pp. 289-312; Vol. 53, 1917, No. 1, pp. 1-82; No. 2, pp. 169-187.

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